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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 1199

89 ASTRONOMY 1200
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1201
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1202
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1203
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1204
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 1205

Note: N.A. means that no abstracts were assigned to this category for this issue.

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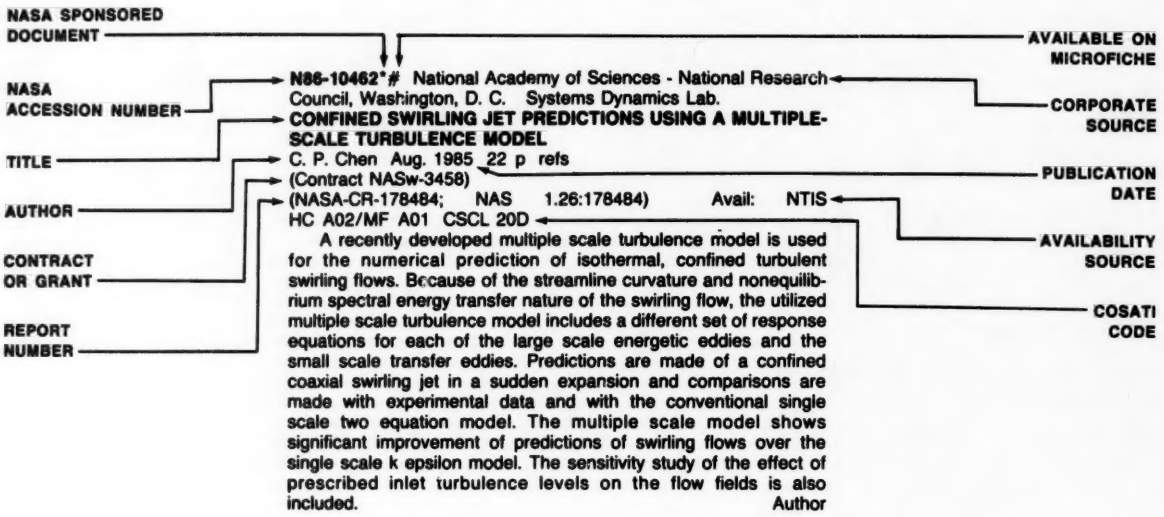
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N86-10462*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NASw-3458)
REPORT NUMBER
(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
AVAILABILITY SOURCE
HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

VOLUME 24 NUMBER 7 / APRIL 8, 1986

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N86-16186* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 193)
Nov. 1985 184 p
(NASA-SP-7037(193); NAS 1.21:7037(193)) Avail: NTIS HC $6.00 CSCL 01A

This bibliography lists 682 reports, articles and other documents introduced into the NASA scientific and technical information system in October 1985. Author

N86-16187*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VORTEX WAKE ALLEVIATION STUDIES WITH A VARIABLE TWIST WING
G. Thomas Holbrook, Dana Morris Dunham, and George C. Greene
Nov. 1985 117 p refs
(NASA-TP-2442; L-15870; NAS 1.60:2442) Avail: NTIS HC A06/MF A01 CSCL 01B

Vortex wake alleviation studies were conducted in a wind tunnel and a water towing tank using a multisegmented wing model which provided controlled and measured variations in span load. Fourteen model configurations are tested at a Reynolds number of one million and a lift coefficient of 0.6 in the Langley 4- by 7-Meter Tunnel and the Hydronautics Ship Model Basin water tank at Hydronautics, Inc., Laurel, Md. Detailed measurements of span load and wake velocities at one semispan downstream correlate well with each other, with inviscid predictions of span load and wake roll up, and with peak trailing-wing rolling moments measured in the far wake. Average trailing-wing rolling moments are found to be an unreliable indicator of vortex wake intensity because vortex meander does not scale between test facilities and free-air conditions. A tapered-span-load configuration, which exhibits little or no drag penalty, is shown to offer significant downstream wake alleviation to a small trailing wing. The greater downstream wake alleviation achieved with the addition of spoilers to a flapped-wing configuration is shown to result directly from the high incremental drag and turbulence associated with the spoilers and not from the span load alteration they cause. Author

N86-16188# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
AIR AND SPACE FLIGHT. DREAM AND FACTS [LUFT- UND RAUMFAHRT. TRAUM UND WIRKLICHKEIT]
Ludwig Boelkow, K. vonGersdorff, and H. J. Ebert 1985 32 p In GERMAN Presented at the opening of the Air and Space Travel Hall of the Deutsches Museum, Munich, West Germany, 6 May 1984 and at Bayerischer Verdienstorden, 20 Jul. 1984
(MBB-Film-382) Avail: NTIS HC A03/MF A01

The history of man's conquest of the air and space with hot air balloons, subsonic and hypersonic aircraft, helicopters and gliders as well as rockets, space shuttles, and manned space flights is reviewed. Progress in aircraft and space technology is discussed. Author (ESA)

N86-16189# Rijksluchtvaartdienst, The Hague (Netherlands).
[ACTIVITIES REPORT IN AERONAUTICS] Annual Report, 1984 [JAARVERSLAG 1984]
1984 62 p In DUTCH
Avail: NTIS HC A04/MF A01

The activities of the Dutch Civil Aeronautics Board (CAB) are reviewed. Air traffic control, airfields, air transportation, aviation security, aviation school, national aeronautics and astronautics museum, and national aeronautics and astronautics laboratory are presented. Regional services in Europe; an aviation accident law; Maastricht airport; and recognition of industries by the CAB are discussed. Author (ESA)

N86-16190# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
PROBLEMS FOUND WHEN INTRODUCING NEW MATERIALS [PROBLEMES POSES PAR L'INTRODUCTION DES MATERIAUX NOUVEAUX]
G. Hilaire 29 Apr. 1985 34 p In FRENCH Presented at Journees de la Technologie 1984, Jonville, France, 5-6 Dec. 1984
(SNIAS-852-551-101; C-47-652-Ac/GH-AT) Avail: NTIS HC A03/MF A01

Aircraft specifications and design problems are discussed. The parameters guiding the choice of new materials are analyzed. Organic matrix composite materials, carbon or glass, aluminum lithium alloys, titanium alloys and metallic matrix composites are examined. The effect of a new material on the aircraft life and maintenance and operation cost is discussed. Fatigue problems and lithium alloys are studied. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-16191# Aeronautical Research Labs., Melbourne (Australia).
A FORTRAN PROGRAM FOR THE DETERMINATION OF UNSTEADY AIRFORCES ON GENERAL COMBINATIONS OF INTERFERING LIFTING SURFACES OSCILLATING IN SUBSONIC FLOW
W. Waldman 1985 92 p refs
(ARL-Struct-R-412; AR-003-987) Avail: NTIS HC A05/MF A01

The aeroelastic stability of an aircraft is an important consideration in the overall process of determining its airworthiness. When external bodies or stores are added to the wing of an aircraft, the dynamic characteristics of the aircraft will be changed. Due to the inertial, elastic and aerodynamic coupling between the wing and

its stores the flutter speed of the aircraft may be adversely affected. The aerodynamic coupling may be particularly important if the stores have aerodynamic surfaces, such as fins, that can generate large oscillatory aerodynamic forces. There are a number of computer programs which predict unsteady aerodynamic forces acting on oscillating lifting surfaces. These programs, which are based on the doublet lattice method of Albano and Rodden were optimized for simple interfering wing-tail-fin and control surface cases. They are not applicable to general combinations of interfering lifting surfaces. Thus a requirement exists for a computer program that can calculate unsteady aerodynamic forces for general configurations of interfering lifting surfaces, including a capability for dealing with store aerodynamics. Since the doublet lattice method is readily applicable to interfering and nonplanar lifting surfaces, it is used as the basis of a program capable of dealing with general configurations. The doublet lattice method is versatile and there are essentially no restrictions on the configurations that can be handled as long as an appropriate idealization can be developed. G.L.C.

N86-16192*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
THE EFFECTS OF ANISOTROPIC FREE-STREAM TURBULENCE ON TURBULENT BOUNDARY LAYER BEHAVIOR Report, 1 Jul. 1984 - 1 Jul. 1985
Fang Liang-Wei and Jon A. Hoffman Nov. 1985 43 p refs
(Grant NsG-2391)
Avail: NTIS HC A03/MF A01 CSCL 01A

The effects of near-isotropic and highly anisotropic free-stream turbulence on mean flow properties of the turbulence structure of turbulent boundary layers in a near zero pressure gradient flow has been experimentally evaluated. Turbulence levels vary from 0.5% to 8.0% and the momentum thickness Reynolds number varies from 800 to 1100. The results indicate that the effects of free-stream turbulence on the classical boundary layer properties for near-isotropic turbulence which have been published by other investigators are similar to the case of highly anisotropic turbulence fields, while the effects of free-stream turbulence on the properties of the turbulent structure within the boundary layer for the case of near-isotropic turbulence are quite different compared to the highly anisotropic case. Author

N86-16193*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AERODYNAMIC CHARACTERISTICS OF A HIGH-WING TRANSPORT CONFIGURATION WITH A OVER-THE-WING NACELLE-PYLON ARRANGEMENT
William P. Henderson and William K. Abeyounis Dec. 1985 93 p refs
(NASA-TP-2497; L-15959; NAS 1.60:2497) Avail: NTIS HC A05/MF A01 CSCL 01A

An investigation has been conducted in the Langley 16-Foot Transonic Tunnel to determine the effects on the aerodynamic characteristics of a high-wing transport configuration of installing an over-the-wing nacelle-pylon arrangement. The tests are conducted at Mach numbers from 0.70 to 0.82 and at angles of attack from -2 deg to 4 deg. The configurational variables under study include symmetrical and contoured nacelles and pylons, pylon size, and wing leading-edge extensions. The symmetrical nacelles and pylons reduce the lift coefficient, increase the drag coefficient, and cause a nose-up pitching-moment coefficient. The contoured nacelles significantly reduce the interference drag, though it is still excessive. Increasing the pylon size reduces the drag, whereas adding wing leading-edge extension does not affect the aerodynamic characteristics significantly. Author

N86-16194*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VALIDATION OF VISCOUS AND INVISCID COMPUTATIONAL METHODS FOR TURBOMACHINERY COMPONENTS
Louis A. Povinelli 1986 19 p refs Proposed for presentation at the 31st International Gas Turbine Conference, Dusseldorf, West Germany; sponsored by ASME
(NASA-TM-87193; E-2765; NAS 1.15:87193) Avail: NTIS HC A02/MF A01 CSCL 01A

An assessment of several three-dimensional computer codes used at the NASA Lewis Research Center is presented. Four flow situations are examined, for which both experimental data and computational results are available. The four flows form a basis for the evaluation of the computational procedures. It is concluded that transonic rotor flow at peak efficiency conditions may be calculated with a reasonable degree of accuracy, whereas, off-design conditions are not accurately determined. Duct flows and turbine cascade flows may also be computed with reasonable accuracy whereas radial inflow turbine flow remains a challenging problem. Author

N86-16195*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NUMERICAL SIMULATION OF THE INVISCID FLOW THROUGH A COUNTER-ROTATING PROPELLER
Mark L. Celestina (Sverdrup Technology, Inc., Cleveland, Ohio), Richard A. Mulac (Sverdrup Technology, Inc., Cleveland, Ohio), and John H. Adamczyk 1986 23 p refs Proposed for presentation at the 31st International Gas Turbine Conference, Dusseldorf, West Germany, 8-12 Jun. 1986; sponsored by ASME
(NASA-TM-87200; E-2855; NAS 1.15:87200) Avail: NTIS HC A02/MF A01 CSCL 01A

The results of a numerical simulation of the time-averaged inviscid flow field through the blade rows of a multiblade row turboprop configuration are presented. The governing equations are outlined along with a discussion of the solution procedure and coding strategy. Numerical results obtained from a simulation of the flow field through a modern high-speed turboprop will be shown. Author

N86-16196*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLOW FIELD SURVEY NEAR THE ROTATIONAL PLANE OF AN ADVANCED DESIGN PROPELLER ON A JETSTAR AIRPLANE
Kevin Robert Walsh 1985 29 p refs
(NASA-TM-86037; H-1226; NAS 1.15:86037) Avail: NTIS HC A03/MF A01 CSCL 01A

An investigation was conducted to obtain upper fuselage surface static pressures and boundary layer velocity profiles below the centerline of an advanced design propeller. This investigation documents the upper fuselage velocity flow field in support of the in-flight acoustic tests conducted on a JetStar airplane. Initial results of the boundary layer survey show evidence of an unusual flow disturbance, which is attributed to the two windshield wiper assemblies on the aircraft. The assemblies were removed, eliminating the disturbances from the flow field. This report presents boundary layer velocity profiles at altitudes of 6096 and 9144 m (20,000 and 30,000 ft) and Mach numbers from 0.6 to 0.8, and it investigated the effects of windshield wiper assemblies on these profiles. Because of the unconventional velocity profiles that were obtained with the assemblies mounted, classical boundary layer parameters, such as momentum and displacement thicknesses, are not presented. The effects of flight test variables (Mach number and angles of attack and sideslip) and an advanced design propeller on boundary layer profiles - with the wiper assemblies mounted and removed - are presented. Author

N86-16197*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MACH NUMBER AND FLOW-FIELD CALIBRATION AT THE ADVANCED DESIGN PROPELLER LOCATION ON THE JETSTAR AIRPLANE
Lannie D. Webb Dec. 1985 21 p refs
(NASA-TM-84923; H-1222; NAS 1.15:84923) Avail: NTIS HC A02/MF A01 CSCL 01A

Advanced design propellers on a JetStar aircraft were tested at NASA Ames Research Center's Dryden Flight Research Facility. A calibration of the flow field at the test location to obtain local Mach number and flow direction was performed. A pitot-static probe

and flow direction vane installation was installed and tested at Mach 0.3 to 0.8 and altitudes from 3000 m (10,000 ft) to 9100 m (30,000 ft). Local Mach number and flow direction relationships were obtained and related to their noseboom counterparts. Effects of varying angles of sideslip to + or - 3 deg. were investigated. Author

N86-16198*# Vigyan Research Associates, Inc., Hampton, Va.
AN INVESTIGATION AT STATIC CONDITIONS OF NONAXISYMMETRIC NOZZLE THRUST REVERSER PORT GEOMETRY INCLUDING EFFECTS OF ROUNDING AND ROTATING THE PORT CORNER
Dorothy G. Arbiter Nov. 1985 56 p refs
(Contract NAS1-17919)
(NASA-CR-178036; NAS 1.26:178036) Avail: NTIS HC A04/MF A01 CSCL 01A

An investigation has been conducted in the static test facility of the Langley 16-Foot Transonic Tunnel to determine the effects of rounding and rotating the port corner of a nonaxisymmetric thrust reversing port. High pressure air was used to simulate jet exhaust at nozzle pressure ratios up to 6.0. The investigation indicates that using a rounded corner in the reverser port passage increases the discharge coefficient significantly compared to that of a sharp cornered thrust reversing port. Incorporating a rotating cylinder into the rounded corner reverser port passage provides no additional increase at cylinder revolutions per minute up to 10,000. (Revolutions per minute of 390,000 were necessary to achieve a surface velocity equal to the duct velocity.) Highest levels of discharge coefficient are obtained by providing a large, round, cylindrical surface in the port upstream wall. Locating the reverser port in a constant area duct results in higher discharge coefficients than locating the port in a convergent duct. Author

N86-16199*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE DISTRIBUTIONS FROM HIGH REYNOLDS NUMBER TESTS OF A BOEING BAC 1 AIRFOIL IN THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL
William G. Johnson, Jr. and Acquilla S. Hill Dec. 1985 271 p refs
(NASA-TM-87600; L-16010; NAS 1.15:87600) Avail: NTIS HC A12/MF A01 CSCL 01A

A wind-tunnel investigation designed to test a Boeing advanced-technology airfoil from low to flight-equivalent Reynolds numbers has been completed in the Langley 0.3-Meter Transonic Cryogenic Tunnel. This investigation represents the first in a series of NASA/U.S. industry two-dimensional airfoil studies to be completed in the Advanced Technology Airfoil Test program. Test temperature was varied from ambient to about 100 K at pressures ranging from about 1.2 to 6.0 atm. Mach number was varied from about 0.40 to 0.80. These variables provided a Reynolds number (based on airfoil chord) range from 4.4 X 10 to the 6th power to 50.0 X 10 to the 6th power. All the test objectives were met. The pressure data are presented without analysis in plotted and tabulated formats for use in conjunction with the aerodynamic coefficient data published as NASA TM-81922. At the time of the test, these pressure data were considered proprietary and have only recently been made available by Boeing for general release. Data are included which demonstrate the effects of fixed transition. Also included are remarks on the model design, the model structural integrity, and the overall test experience. Author

N86-16200# Sandia National Labs., Albuquerque, N. Mex.
SIX DEGREE OF FREEDOM SIMULATION OF FLUID PAYLOAD PROJECTILES USING NUMERICALLY COMPUTED FLUID MOMENTS
H. R. Vaughn, W. P. Wolf, and W. L. Oberkampf Jul. 1985 102 p
(Contract DE-AC04-76DP-00789)
(DE85-017183; SAND-85-1166) Avail: NTIS HC A06/MF A01

A flight trajectory simulation method has been developed for calculating a six degree of freedom motion of fluid filled projectiles. Numerically calculated internal fluid moments and experimentally known aerodynamic forces and moments are coupled to the projectile motion. Comparisons of predicted results with flight test data of an M483 155mm artillery projectile with a highly viscous payload confirm the accuracy of the simulation. This simulation clearly shows that the flight instability is due to the growth of the nutation component of angular motion caused by the viscous effects of the fluid payload. This simulation procedure, when used in conjunction with the previously developed method for calculating internal fluid moments, allows the designer to examine the effects of various liquid payloads and container geometries on the dynamic behavior of flight vehicles. DOE

N86-16201# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
SIMULATION OF FLOW AROUND A BLUNT BODY IN A SUPERSONIC STREAM
Liu Jun Mar. 1985 29 p
(PDR/CFDU/IC/20) Avail: NTIS HC A03/MF A01

The steady flow around a blunt body immersed in a uniform and two-dimensional supersonic stream was simulated by PHOENICS-84. The resulting solutions compare well with experimental data and with other numerical results. Author (ESA)

N86-16202# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
IMPLICIT FINITE-DIFFERENCE METHODS FOR THE CALCULATION OF UNSTEADY TRANSONIC POTENTIAL FLOW AROUND TWO-DIMENSIONAL AIRFOILS: A DISCUSSION
J. vanderVooren and H. Schippers 23 Sep. 1985 33 p refs Submitted for publication
(NLR-MP-83063-U; B8566372) Avail: NTIS HC A03/MF A01

Mathematical modeling of unsteady transonic flow is discussed. Starting from the Euler equations, potential theory is derived and applied to the flow about a 2D airfoil. Motions considered include rigid body motions and deformations of the airfoil. The full-potential equation is formulated on curvilinear coordinates maintaining strong conservation form. Boundary conditions on the airfoil, wake conditions and radiation type far-field conditions are assessed. A numerical method based on time-linearization of the differential equation up to second order accuracy is presented. The resulting equation can be integrated numerically by an implicit locally one-dimensional split method. Approximation of spatial derivatives by fully conservative finite difference schemes employing mass-flux splitting for the capture of shocks is treated. Results for the steady flow about an airfoil illustrate that an Engquist-Osher type scheme at the sonic line is a prerequisite to rigorously suppress nonphysical expansion shocks. Author (ESA)

N86-16203# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE ENTRAINMENT INTO A LEADING-EDGE VORTEX
N. G. Verhaagen and L. vanderSnoek 1984 60 p refs
(VTH-LR-332) Avail: NTIS HC A04/MF A01

The theoretical distribution of the velocity inside the rotational core of a leading-edge is derived using Stewartson and Hall's (1963) outer solution for the rotational core. From it the entrainment into and the circulation around the rotational core is derived. The theoretical results are compared with results from measurements on the leading-edge vortex of a sharp-edged unit aspect ratio delta wing. The measurements were performed for an angle of attack of 20 deg at 45 m/sec, corresponding to a Reynolds number of 2.5 million, based on centerline chord. A relation for the entrainment factor found in the literature is shown to be incorrect. Author (ESA)

N86-16204# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
APPLICATION OF TIME-LINEARIZED METHODS OF OSCILLATING WINGS IN TRANSONIC FLOW AND FLUTTER
M. H. L. Hounjet and J. J. Meijer 15 Aug. 1984 21 p refs Presented at AGARD Specialists Meeting on Unsteady Aerodynamics and Aeroelastic Applications, Toulouse, France, 2-7 Sep.

1984 Sponsored by Royal Netherlands Air Force, The Hague
(NLR-MP-84077-U; B8569322) Avail: NTIS HC A02/MF A01

Unsteady aerodynamic loads in the transonic domain were obtained with time-linearized methods in which a so-called field panel method which accounts for a proper radiation of signals towards infinity is embedded. The methods are used to predict the unsteady loads and first harmonic pressure distributions on an airfoil and a transport type wing. Results are correlated with data of unsteady experiments and of other calculation methods. Transonic flutter applications to a fighter-type configuration are described. Author (ESA)

N86-16205# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
CALCULATIONS OF TRANSONIC FLOWS AROUND SINGLE AND MULTIELEMENT AIRFOILS ON A SMALL COMPUTER
Z. Nowak 1984 32 p refs Sponsored by Netherlands Organization for the Advancement of Pure Research
(Rept-84-48) Avail: NTIS HC A03/MF A01

A method based on finite volume discretization of the full potential equation with artificial compressibility for calculating transonic flows around single and multielement airfoils is presented. The velocity potential is calculated on a succession of grids by the line-Newton method. For multielement airfoils, the channels between the component parts are treated with the line-Newton relaxation or underrelaxation procedure. The method is quite efficient for relatively coarse grids (size 21 x 64 or 17 x 64). For finer grids convergence could be improved by multigrid methods. A method for generating nearly orthogonal grids in double-connected regions using simple semianalytic formulas is given. The grids are strictly orthogonal at the inner boundary.
Author (ESA)

N86-16206# European Space Agency, Paris (France).
INVESTIGATION OF THE AERODYNAMIC FORCES ON BLUFF BODIES AT HIGH REYNOLDS NUMBERS Final Report
Guenter Schewe Jun. 1985 37 p refs Transl. into ENGLISH of "Untersuch. der aerodynamischen Kraeft, die auf stumpfe Profile bei grossen Reynolds-Zahlen Wirken" Report DFVLR-Mitt-84-19 Goettingen, West Germany, 1984 Original report in GERMAN previously announced as ESA-94556
(ESA-TT-914; DFVLR-Mitt-84-19) Avail: NTIS HC A03/MF A01; original German version available from DFVLR, Cologne DM 13

Steady and unsteady forces acting on a circular cylinder, a square-section cylinder and an H-profile (Tacoma Bridge) were investigated in a pressurized wind tunnel (very high Reynolds numbers). The forces were measured by a piezo-multicomponent balance, which features a large dynamic range, low interference and a high natural frequency. The Reynolds number (Re) range between 20,000 and 7 million is investigated with the same circular cylinder and balance by merely varying flow velocity and air density. In the critical Reynolds number range, bistable asymmetric flow states which can be controlled by a very small perturbation are observed. The investigation of the square section reveals no strong Reynolds number effects in the range Re between 100,000 and 4 million. The Tacoma profile is shown to be aeroelastically unstable in torsion mode. Author (ESA)

N86-16574# Joint Publications Research Service, Arlington, Va.
IMPROVED METHOD FOR TRANSONIC FLOW CALCULATION PROPOSED
Luo Shifeng *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 24-33 refs Transl. into ENGLISH from Shuzhi Jisuan yu Jisuanji Yingyong (Beijing, China), v. 6, no. 1, Mar. 1985 p 57-64 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-16207# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: MIDAIR COLLISION OF WINGS WEST AIRLINES BEECH C-99 (N666U) AND AESTHETEC INC., ROCKWELL COMMANDER (N112SM), NEAR SAN LUIS OBISPO, CALIFORNIA, AUGUST 24, 1984
24 Aug. 1984 52 p
(NTSB/AAR-85/07) Avail: NTIS HC A04/MF A01

At 1117:38 Pacific daylight time, on August 24, 1984, Wings West Airlines, Flight 628, a Beech C-99 (N6399U), and Aesthetec Inc., Rockwell Commander 112TC, N112SM, collided in midair near San Luis Obispo, California. The weather at the time of the collision was clear. Flight 628 had just departed San Luis Obispo County Airport en route to San Francisco International Airport, California, and was climbing on a westbound heading. The Rockwell Commander had departed Paso Robles, California, on a training flight and was descending toward the San Luis Obispo County Airport on an eastbound track. The airplanes collided head-on at an altitude of about 3,400 feet. The wreckage of both airplanes fell into an open field 8 nmi west northwest of the San Luis Obispo County Airport. All 17 persons, including the 2 pilots and 13 passengers onboard flight 628 and the 2 pilots onboard the Rockwell, were killed. The National Transportation Safety Board determines that the probable cause of this accident was the failure of the pilots of both aircraft to follow the recommended communications and traffic advisory practices for uncontrolled airports contained in the Airman's Information Manual to alert each other to their presence and to enhance the controller's ability to provide timely traffic advisories. Author

N86-16208*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME COMPARISONS OF US AND USSR AIRCRAFT DESIGN DEVELOPMENTS
M. Leroy Spearman Dec. 1985 36 p refs Previously announced in IAA as A86-10930
(NASA-TM-87611; NAS 1.15:87611) Avail: NTIS HC A03/MF A01 CSCL 01C

A review is given of the design and development of some US and USSR aircraft. The emphasis is on the historical development of large aircraft-civil and military transports and bombers. Design trends are somewhat similar for the two countries and indications are that some fundamental characteristics are dictated more by ideological differences rather than technological differences. A brief description is given in a more or less chronological order of the major bomber aircraft, major civil and military transport aircraft, and the development of the air transport systems. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-16209 Civil Aviation Authority, London (England).
EVALUATION OF 23 INCH RADAR VIEWING UNIT FOR HEATHROW APPROACH CONTROL ROOM
Jul. 1985 24 p ref
(CAA-Paper-85011; Rept-516) Copyright. Avail: Issuing Activity

The possibility of replacing pairs of 16 in approach radar viewing units (RVU) by single 23 in units was assessed in a simulation with 20 air traffic controllers. The subjective and numerical evidence indicates that a single 23 inch RVU is an acceptable replacement. The lack of suitable range settings made it difficult for controllers to comment about the suitability of the RVU for the initial planning task. However, the indications are that the monitoring and sequencing tasks could be carried out satisfactorily. In the event of an RVU failure, a controller could maintain a radar service for a maximum of 5 min by sharing a neighboring RVU. Author (ESA)

N86-16210# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
AUTOMATIC NULL-STEERING ANTENNA SYSTEMS FOR NAVSTAR GLOBAL POSITIONING SYSTEM (GPS)
O. B. M. Pietersen 12 Jan. 1984 11 p refs In DUTCH; ENGLISH summary Presented at Dutch Electronics and Radio Society (NERG) Meeting on Subjects Related to Military Communication, 31 Jan. 1984 Submitted for publication
(NLR-MP-84007-U; B8566262) Avail: NTIS HC A02/MF A01

Null-steering antenna systems for user equipment in the NAVSTAR Global Positioning System are reviewed. The antenna pattern is adapted automatically to a scenario with jammers. While trying to continue the reception of the spread spectrum satellite signals, an attenuation of jamming signals is provided. Three methods leading to optimal weight factors, (direct matrix inversion, steepest descent, and perturbation method) are outlined.
Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-16211# National Aerospace Lab., Amsterdam (Netherlands). Hoofdafd. Stromingen.
FATIGUE LIFE MONITORING OF AIRCRAFT
J. B. deJonge 27 Oct. 1983 10 p In DUTCH; ENGLISH summary Presented at Netherlands Association of Aeronautical Engineers, 1 Dec. 1983
(NLR-MP-83069-U; B8568105) Avail: NTIS HC A02/MF A01

Methods for monitoring fatigue loads on aircraft structures are presented. As the actual service life deviates appreciably from design load spectrum assumptions, a reassessment of safe service life and inspection schedules are shown to be necessary. Simple counting accelerometer systems; multiparameter recording systems; and direct strain monitoring systems are discussed. Examples of combat aircraft and civil transport aircraft are presented. The interpretation of recorded loads in terms of accumulated fatigue damage is considered. Author (ESA)

N86-16653# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIRWORTHINESS FLIGHT TEST PROGRAM OF AN AIRCRAFT EQUIPMENT FAIRING
V. R. Miller and T. P. Severyn (4950th Test Wing, Wright-Patterson AFB, Ohio) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 69-75 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 01/3

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N86-16212*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FINDS: A FAULT INFERRING NONLINEAR DETECTION SYSTEM PROGRAMMERS MANUAL, VERSION 3.0
Roy E. Lancraft Dec. 1985 174 p refs
(Contract NAS1-16579)
(NASA-CR-177986; NAS 1.26:177986; Rept-6012) Avail: NTIS HC A08/MF A01 CSCL 01D

Detailed software documentation of the digital computer program FINDS (Fault Inferring Nonlinear Detection System) Version 3.0 is provided. FINDS is a highly modular and extensible computer program designed to monitor and detect sensor failures, while at the same time providing reliable state estimates. In this version of the program the FINDS methodology is used to detect, isolate, and compensate for failures in simulated avionics sensors used by the Advanced Transport Operating Systems (ATOPS) Transport System Research Vehicle (TSRV) in a Microwave Landing System (MLS) environment. It is intended that this report serve as a programmers guide to aid in the maintenance, modification, and revision of the FINDS software. Author

N86-16213# Eikonix Corp., Bedford, Mass.
EXTENDED AREA EXIT PUPIL VIEWER Final Technical Report, 5 Aug. 1983 - 5 Aug. 1985
B. Radl Aug. 1985 63 p
(Contract DACA76-83-C-0008)
(AD-A159364; EC/2129101; ETL-0399) Avail: NTIS HC A04/MF A01 CSCL 17/8

This report describes the process of designing and building a prototype extended area exit pupil viewer. This system will enable comfortable viewing of a projected stereo image. It works by enlarging the microscope's exit pupil, thus allowing head movement while maintaining stereo separation of the images. GRA

N86-16214# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
STRESS LEVEL TESTING OF ELECTRONICS, AVIONICS COMMUNICATIONS AND C3I EQUIPMENTS Final Report
30 Aug. 1985 28 p
(AD-A159395; TOP-6-1-002) Avail: NTIS HC A03/MF A01 CSCL 17/2

This Test Operations Procedure (TOP) describes test methods and techniques for measuring and evaluating the technical performance of a System Under Test (SUT) when the SUT is operated to and beyond specifications in order to determine its response to high levels of stimuli. The extremely short period allowed for the writing of this TOP along with the great diversity of potential systems to be tested has precluded the writing of a document which conclusively covers the topic of stress level testing. This document should be considered as a TOP which outlines the basic requirements and the basic test methodology for conducting stress level testing. This TOP includes only the electronics aspect of stress level testing. It does not consider the classical environmental and mechanical stress testing of materials; these types of stress testing are covered in MIL-STD-810D.
GRA

N86-16215# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
DESIGN AND EVALUATION OF AN INSTRUMENTATION SYSTEM FOR MEASUREMENTS IN NONSTEADY SYMMETRICAL FLIGHT CONDITIONS WITH THE HAWKER HUNTER MK7
K. vanWoerkom 1984 83 p refs
(VTH-LR-308) Avail: NTIS HC A05/MF A01

A flight test instrumentation system with a sample of rate 400 measurements/sec, and 0.02% overall accuracy is de-

scribed. The system was used to perform nonsteady symmetric flight tests with a Hawker Hunter aircraft. The design and evaluation of transducers, signal conditioning, and the data collection system are outlined. The program demonstrates the technique of measuring performance characteristics as well as stability and control characteristics simultaneously in dynamic flight conditions.
Author (ESA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-16216*# United Technologies Research Center, East Hartford, Conn.
OPTICAL AND PROBE DETERMINATION OF SOOT CONCENTRATIONS IN A MODEL GAS TURBINE COMBUSTOR Final Report
Wayne A. Eckerle and Thomas J. Rosfjord Jan. 1986 99 p refs
(Contract NAS 3-242233)
(NASA-CR-175030; NAS 1.26:175030) Avail: NTIS HC A05/MF A01 CSCL 21E

An experimental program was conducted to track the variation in soot loading in a generic gas turbine combustor. The burner is a 12.7-cm dia cylindrical device consisting of six sheet-metal louvers. Determination of soot loading along the burner length is achieved by measurement at the exit of the combustor and then at upstream stations by sequential removal of liner louvers to shorten burner length. Alteration of the flow field approaching and within the shortened burners is minimized by bypassing flow in order to maintain a constant linear pressure drop. The burner exhaust flow is sampled at the burner centerline to determine soot mass concentration and smoke number. Characteristic particle size and number density, transmissivity of the exhaust flow, and local radiation from luminous soot particles in the exhaust are determined by optical techniques. Four test fuels are burned at three fuel-air ratios to determine fuel chemical property and flow temperature influences. Particulate concentration data indicate a strong oxidation mechanism in the combustor secondary zone, though the oxidation is significantly affected by flow temperature. Soot production is directly related to fuel smoke point. Author

N86-16217# Johns Hopkins Univ., Laurel, Md. JANNAF Combustion Subcommittee.
RECOMMENDATIONS FOR REPORTING RAMJET COMBUSTION INSTABILITY TEST DATA
Douglas L. Davis, ed. (AFWAL) Sep. 1985 26 p refs
(Contract N00024-85-C-5301)
(AD-A161008; CPIA-Publ-420) Avail: NTIS HC A03/MF A01 CSCL 21/5

A technical panel of the Joint Army-Navy-NASA-Air Force (JANNAF) Combustion Subcommittee, presents guidelines for reporting high-frequency pressure oscillations in ramjets. Also included are brief engineering descriptions of the various techniques, including stochastic signal analysis, for presenting combustion instability data. Author

N86-16218*# Sverdrup Technology, Inc., Cleveland, Ohio.
PREDICTION OF THE STRUCTURE OF FUEL SPRAYS IN GAS TURBINE COMBUSTORS Final Report
Jian-Shun Shuen Dec. 1985 17 p refs Presented at the 24th Aerospace Sciences Meeting, Reno, Nev., 6-9 Jan. 1986; sponsored by AIAA
(Contract NAS3-24105)
(NASA-CR-175028; E-2837; NAS 1.26:175028; AIAA-86-0450) Avail: NTIS HC A02/MF A01 CSCL 21E

The structure of fuel sprays in a combustion chamber is theoretically investigated using computer models of current interest. Three representative spray models are considered: (1) a locally homogeneous flow (LHF) model, which assumes infinitely fast interphase transport rates; (2) a deterministic separated flow (DSF) model, which considers finite rates of interphase transport but ignores effects of droplet/turbulence interactions; and (3) a stochastic separated flow (SSF) model, which considers droplet/turbulence interactions using random sampling for turbulence properties in conjunction with random-walk computations for droplet motion and transport. Two flow conditions are studied to investigate the influence of swirl on droplet life histories and the effects of droplet/turbulence interactions on flow properties. Comparison of computed results with the experimental data show that general features of the flow structure can be predicted with reasonable accuracy using the two separated flow models. In contrast, the LHF model overpredicts the rate of development of the flow. While the SSF model provides better agreement with measurements than the DSF model, definitive evaluation of the significance of droplet/turbulence interaction is not achieved due to uncertainties in the spray initial conditions. DOE

N86-16219*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF CALCULATED AND EXPERIMENTAL CASCADE PERFORMANCE FOR CONTROLLED-DIFFUSION COMPRESSOR STATOR BLADING
Nelson L. Sanger and Raymond P. Shreeve (Naval Postgraduate School, Monterey, Calif.) 1986 22 p refs Presented at International Gas Turbine Conference and Exhibit, Dusseldorf, West Germany, 8-12 Jun. 1986; sponsored by ASME
(NASA-TM-87167; E-2805; NAS 1.15:87167) Avail: NTIS HC A04/MF A01 CSCL 21E

The mid-span section of a previously reported controlled-diffusion compressor stator has been experimentally evaluated in cascade. Measurements are taken over a range of incidence angles for blade chord Reynolds numbers from 470,000 to 690,000. Blade chord length is 12.7 cm, aspect ratio is 2.0, and solidity is 1.67. Measurements include conventional cascade performance parameters as well as blade surface pressures. Computations are made for the inviscid flow field, surface boundary layers, and loss for several of the blade inlet angle conditions, are compared against corresponding data. Author

N86-16220*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
THERMODYNAMIC EVALUATION OF TRANSONIC COMPRESSOR ROTORS USING THE FINITE VOLUME APPROACH Annual Report, 20 Dec. 1984 - 19 Dec. 1985
John Moore, Stephen Nicholson, and Joan G. Moore Dec. 1985 118 p refs
(Grant NAG3-593)
(NASA-CR-176428; NAS 1.26:176428; JM/85-11) Avail: NTIS HC A06/MF A01 CSCL 21E

Research at NASA Lewis Research Center gave the opportunity to incorporate new control volumes in the Denton 3-D finite-volume time marching code. For duct flows, the new control volumes require no transverse smoothing and this allows calculations with large transverse gradients in properties without significant numerical total pressure losses. Possibilities for improving the Denton code to obtain better distributions of properties through shocks were demonstrated. Much better total pressure distributions through shocks are obtained when the interpolated effective pressure, needed to stabilize the solution procedure, is used to calculate the total pressure. This simple change largely eliminates the undershoot in total pressure down-stream of a shock. Overshoots and undershoots in total pressure can then be further reduced by a factor of 10 by adopting the effective density method, rather than the effective pressure method. Use of a Mach number dependent interpolation scheme for pressure then removes the overshoot in static pressure downstream of a shock. The stability of interpolation schemes used for the calculation of effective density is analyzed and a Mach number dependent scheme is developed,

combining the advantages of the correct perfect gas equation for subsonic flow with the stability of 2-point and 3-point interpolation schemes for supersonic flow. Author

N86-16221*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATING A SMALL TURBOSHAFT ENGINE IN REAL-TIME MULTIPROCESSOR SIMULATOR (RTMPS) ENVIRONMENT
Edward J. Milner and Dale J. Arpasi Jan. 1986 25 p refs Presented at the SCS Multiconference, San Diego, Calif., 23-25 Jan. 1986; sponsored by the Society for Computer Simulation
(NASA-TM-87216; E-2876; NAS 1.15:87216) Avail: NTIS HC A02/MF A01 CSCL 21E

A Real-Time Multiprocessor Simulator (RTMPS) has been developed at NASA Lewis Research Center. The RTMPS uses parallel microprocessors to achieve computing speeds needed for real-time engine simulation. This report describes the use of the RTMPS system to simulate a small turboshaft engine. The process of programming the engine equations and distributing them over one, two, and four processors is discussed. Steady-state and transient results from the RTMPS simulation are compared with results from a main-frame-based simulation. Processor execution times and the associated execution time savings for the two and four processor cases are presented using actual data obtained from the RTMPS system. Included is a discussion of why the minimum achievable calculation time for the turboshaft engine model was attained using four processors. Finally, future enhancements to the RTMPS system are discussed including the development of a generalized partitioning algorithm to automatically distribute the system equations among the processors in optimum fashion. Author

N86-16222# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
SPANWISE REDISTRIBUTION OF ENERGY AND LOSS IN AN AXIAL FLOW COMPRESSOR BY WAKE CENTRIFUGATION Final Report, 15 Sep. 1981 - 15 Mar. 1984
C. W. Whitfield and J. S. Keith May 1985 119 p
(Contract F33615-81-C-2090)
(AD-A159312; R84AEB460; AFWAL-TR-84-2109) Avail: NTIS HC A06/MF A01 CSCL 20/4

The objective of this program was to develop and codify a method for predicting the spanwise redistribution of energy and loss associated with rotor/stator wakes in an axial-flow compressor. The mechanisms considered were: (1) spanwise transport of wake fluid due to imbalance of the radial pressure gradient; and (2) accumulation/dilution of wake fluid at the inner and outer casing. The work consisted of developing computer modules that perform the above defined objectives. This report describes mathematical formulas derived for definition of the peak radial and streamwise velocity decrements/increments in a wake at a blade trailing edge and their decay with downstream distance. Comparisons with data show good agreement in most cases. In addition, the thickness, displacement thickness, and momentum thickness of the wake were calculated and used in the prediction of changes in the circumferential average flow solution caused by the migration of wake fluid across streamlines. GRA

N86-16223# Rolls-Royce Ltd., Derby (England).
THE MECHANICAL DESIGN OF GAS TURBINE BLADING IN CAST SUPERALLOYS
A. G. Dodd 27 Feb. 1985 47 p refs
(PNR-90247) Avail: NTIS HC A03/MF A01

The methods used for the mechanical design of hot gas turbine blading are discussed. A rapid mechanical assessment, done before the design proceeds further, is examined. The method gives an outline of the design specifying material choice, rim load on disks, cross sectional areas and mean level of cooling technology. Failure modes are discussed. It is suggested that they can be overcome by choosing a temperature and stress for each radial position. Blades are optimized by varying the required cooling technology or by changing the cross-sectional areas. Author (ESA)

N86-16224# Rolls-Royce Ltd., Derby (England). Mechanical Technology Dept.
AN ANALYSIS OF RIG TEST DISC FAILURES
G. Asquith 23 Jul. 1985 10 p refs
(PNR-90276) Avail: NTIS HC A02/MF A01

Life prediction criteria for hot gas turbine engine disks are examined. Safety is taken as the prime requirement in turbine design. Factors influencing the total life, and the prediction methods available are discussed. Engine size disk testing to cracking and failure is seen as the most reliable. This is equivalent to the mathematical Monte Carlo analysis. The tests also show which variables are most likely to be significant. Author (ESA)

N86-16225# Rolls-Royce Ltd., Derby (England).
CERTIFICATION OF AEROENGINES FITTED WITH FULL AUTHORITY DIGITAL CONTROL
V. A. Fisher 23 Jul. 1985 24 p Presented at Certification of Aerospace Propulsion Systems Seminar, Bangalore, India, 6-7 Mar. 1985
(PNR-90287) Avail: NTIS HC A02/MF A01

The problem of certifying electronic control systems as part of the aircraft engine is discussed. The certification is divided into verification and validation of the software and the hardware. Hardware testing includes environmental aspects such as temperature, vibration, electromagnetic compatibility, shock, sand and dust. Software by its very nature can only be presented to human perception by means of documentation. Author (ESA)

N86-16226# Rolls-Royce Ltd., Derby (England).
IS THE TRADITIONAL 150 HOUR ENDURANCE TEST OUTDATED?
R. Ebbs 23 Jul. 1985 30 p Presented at Certification of Aerospace Propulsion Systems Seminar, Bangalore, India, 6-7 Mar. 1985
(PNR-90288) Avail: NTIS HC A03/MF A01

Qualification tests necessary for the granting of aircraft engine type approval are discussed. The evolution of the 150 hr test is described. The shortcomings of these tests are analyzed, together with attempts to modify the tests to be more representative. The direction which the formal requirements are likely to take in the future is considered. Author (ESA)

N86-16227# European Space Agency, Paris (France).
HOT CORROSION IN AIRCRAFT ENGINES
Hans-Joachim Retzer-Scheibe Feb. 1985 242 p refs Transl. into ENGLISH of "Heissgaskorrosion in Flugtriebwerken" Cologne, West Germany, 1984 Original report in GERMAN previously announced as ESA-92820
(ESA-TT-887; DFVLR-Mitt-84-04) Avail: NTIS HC A11/MF A01; original German version available from DFVLR, Cologne DM 67

Hot corrosion behavior of high temperature materials, in particular heat resistant alloys used in aircraft gas turbines is reviewed. Corrosion phenomena of Ni-base and Co-base alloys were examined by burner rig tests, and protective coating systems were studied. It is found that the alloying constituents Cr, Ti, and Y improve the hot corrosion resistance while Fl, Mo, and W deteriorate the sulfurization resistance. Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-16228*# Connecticut Univ., Storrs.
AN INVESTIGATION OF ADAPTIVE CONTROLLERS FOR HELICOPTER VIBRATION AND THE DEVELOPMENT OF A NEW DUAL CONTROLLER Final Report
Purusottam Mookerjee, John A. Molusis, and Yaakov Bar-Shalom Jan. 1985 162 p refs
(Grant NAG2-213)

(NASA-CR-177377; NAS 1.26:177377) Avail: NTIS HC A08/MF A01 CSCL 01C

An investigation of the properties important for the design of stochastic adaptive controllers for the higher harmonic control of helicopter vibration is presented. Three different model types are considered for the transfer relationship between the helicopter higher harmonic control input and the vibration output: (1) nonlinear; (2) linear with slow time varying coefficients; and (3) linear with constant coefficients. The stochastic controller formulations and solutions are presented for a dual, cautious, and deterministic controller for both linear and nonlinear transfer models. Extensive simulations are performed with the various models and controllers. It is shown that the cautious adaptive controller can sometimes result in unacceptable vibration control. A new second order dual controller is developed which is shown to modify the cautious adaptive controller by adding numerator and denominator correction terms to the cautious control algorithm. The new dual controller is simulated on a simple single-control vibration example and is found to achieve excellent vibration reduction and significantly improves upon the cautious controller. Author

N86-16229# European Space Agency, Paris (France).
FLIGHT DYNAMICS AND AIRCRAFT PILOTING
Jean-Claude Wanner May 1985 419 p refs Transl. into ENGLISH of "Dyn. du Vol et Pilotage des Avions" ONERA-P-1983-1 Paris, France, 1983 Revised
(ESA-TT-874; ONERA-P-1983-1; ONERA-P-1976-6-Rev) Avail: NTIS HC A18/MF A01

The principle of piloted vehicle mechanics is presented, and aircraft longitudinal movement is studied. Assuming that the pilot counters with his lateral controls any sideslip, and that the aircraft plane of symmetry is vertical, the trajectory is described in that same vertical plane. The natural modes (angle of attack oscillation, phugoid, aperiodic motion) of the small movements around straight and level flight, the response to the pilots commands, and equilibrium stability, are examined. Small lateral movements around straight and level flight and the aircraft response to lateral controls are considered. Small movements of the aircraft around stabilized level flight in rotation are also examined. The assumptions of separation of longitudinal and lateral movements around stabilized straight and level flight are validated. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-16230 Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
SIMULATION OF A SIX DEGREES OF FREEDOM FLIGHT SIMULATOR MOTION SYSTEM
G. J. Wierda 1 May 1982 47 p refs
(UA-00-39) Avail: Issuing Activity

A model of a single hydraulic actuator and controller developed to investigate nonlinearities in the servo valve transfer function to limit the amount of hardware in the simulation, was simplified by linearizing the square roots in the pressure-flow relationship. Six of the simplified models were coupled to obtain a simulation model of a complete six degrees of freedom motion system. A transformation and mass matrix to describe the dynamic equations were calculated for a motion system. Simulation results indicate high underdamped frequency components in the acceleration response of the actuators. It is shown that acceleration feedback rather than force feedback is preferred to damp the high frequency components. Author (ESA)

N86-16231# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PCM SIMULATOR [SIMULADOR PCM]
Pedro Manuel MartinsdeBarros and Ricardo Correia Lima Jul. 1985 16 p Presented at the 37th Reuniao Anual da SBPC, Belo Horizonte, Brazil, 10-17 July 1985
(INPE-3571-PRE/775) Avail: NTIS HC A02/MF A01

The PCM simulator is a device that generates baseband binary sequences of programmable length and pattern mainly to check decommutation systems. Thus, the simulator can be used not only to check decommutators but also to any equipment that needs, at the input, a programmable sequence of bits. The programming capacity varies according to the use. The PCM simulator of the MECB's earth stations generates superframes of 1 to 256 frames, each frame with 1 to 1024 8 bit words. There are 17 programmable words: 16 can be inserted in any address of the superframe, once per frame, or in up to 8 frames. The seventeenth is a fill. The generation is based in two tables: a compact one, which has all the information needed to build the frames; the other contains all the programmable words in the proper order, so that the desired sequence is obtained. The generation of this table and I/O operations are performed by a microprocessor based on the CPU 8085 INTEL. Author

N86-16232*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDY OF ICE ACCRETION ON ICING WIND TUNNEL COMPONENTS
James E. Newton and William Olsen 1986 24 p refs Presented at the 24th Aerospace Sciences Meeting, Reno, Nev., 6-8 Jan. 1986; sponsored by AIAA
(NASA-TM-87095; E-3828; NAS 1.15:87095) Avail: NTIS HC A02/MF A01 CSCL 01E

In a closed loop icing wind tunnel the icing cloud is simulated by introducing tiny water droplets through an array of nozzles upstream of the test section. This cloud will form ice on all tunnel components (e.g., turning vanes, inlet guide vanes, fan blades, and the heat exchanger) as the cloud flows around the tunnel. These components must have the capacity to handle their icing loads without causing significant tunnel performance degradation during the course of an evening's run. To aid in the design of these components for the proposed Altitude Wind Tunnel (AWT) at NASA Lewis Research Center the existing Icing Research Tunnel (IRT) is used to measure icing characteristics of the IRT's components. The results from the IRT are scaled to the AWT to account for the AWT's larger components and higher velocities. The results show that from 90 to 45 percent of the total spray cloud froze out on the heat exchanger. Furthermore, the first set of turning vanes downstream of the test section, the FOD screen and the fan blades show significant ice formation. The scaling shows that the same results would occur in the AWT. Author

N86-16233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROGRESS IN THE LEWIS RESEARCH CENTER ALTITUDE WIND TUNNEL (AWT) MODELING PROGRAM
Carl C. Ciepluch, Richard R. Burley, Donald E. Groesbeck, and John C. Marek 1986 19 p refs Proposed for presentation at the 14th Aerodynamic Testing Conference, West Palm Beach, Fla., 5-7 Mar. 1986; sponsored by AIAA
(NASA-TM-87194; E-2850; NAS 1.15:87194) Avail: NTIS HC A02/MF A01 CSCL 14B

The rehabilitation of the Altitude Wind Tunnel (AWT) at the NASA Lewis Research Center is under study with the goal of providing a modern subsonic wind tunnel for conducting propulsion system/airframe integration, isolated propulsion system, propulsion acoustics and adverse weather tests. Because of the increased Mach number capability (from Mach 0.6 to 0.9 plus) and the incorporation of acoustic and adverse weather capabilities into an existing tunnel, the AWT rehabilitation represents a significant technical challenge. In order to reduce the risk associated with such an undertaking, and extensive AWT modeling program is being conducted to guide and verify the tunnel design. Significant

findings and progress in this modeling program are the subject of this paper. Author

N86-16234*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE CONSTRUCTION OF AIRFOIL PRESSURE MODELS BY THE PLATE METHOD: ACHIEVEMENTS, CURRENT RESEARCH, TECHNOLOGY DEVELOPMENT AND POTENTIAL APPLICATIONS
Pierce L. Lawing Sep. 1985 34 p refs
(NASA-TM-87613; NAS 1.15:87613) Avail: NTIS HC A03/MF A01 CSCL 14B

A method of constructing airfoils by inscribing pressure channels on the face of opposing plates, bonding them together to form one plate with integral channels, and contour machining this plate to form an airfoil model is described. The research and development program to develop the bonding technology is described as well as the construction and testing of an airfoil model. Sample aerodynamic data sets are presented and discussed. Also, work currently under way to produce thin airfoils with camber is presented. Samples of the aft section of a 6 percent airfoil with complete pressure instrumentation including the trailing edge are pictured and described. This technique is particularly useful in fabricating models for transonic cryogenic testing, but it should find application in a wide ange of model construction projects, as well as the fabrication of fuel injectors, space hardware, and other applications requiring advanced bonding technology and intricate fluid passages. Author

N86-16235# Duits-Nederlandse Windtunnel, Noordoostpolder (Netherlands).
GERMAN-DUTCH WIND TUNNEL (DNW). PRESENT AND FUTURE APPLICATIONS FOR INDUSTRIAL DEVELOPMENTS [DEUTSCH-NIEDERLAENDISCHER WINDKANAL (DNW). GEGENWAERTIGER UND KUENFTIGER EINSATZ FUER INDUSTRIELLE ENTWICKLUNGEN]
J. Barche 1983 43 p refs In GERMAN Presented at 3rd BMFT Statusseminar Luftfahrtforschung und Luftfahrttechnology, Hamburg, West Germany, 2-4 May 1983
Avail: NTIS HC A03/MF A01

The German-Dutch wind tunnel was designed to perform aerodynamic and aeroacoustic development investigations in the subsonic range. The wind tunnel is composed of closed test sections with transverse sections of 6 m x 6 m, 8 m x 6 m and 9.5 m x 9.5 m and with respective velocity of 150, 120, and 60 m/sec, and of open test sections with 8 m x 6 m entry surface and with a maximum velocity of 80 m/sec. The tunnel is applied for productive testing of aircraft, vehicles and civil engineering, for demonstration, calibration and system integration. Author (ESA)

N86-16236# Duits-Nederlandse Windtunnel, Noordoostpolder (Netherlands).
AEROACOUSTIC CALIBRATION OF THE GERMAN-DUTCH WIND TUNNEL (DNW) OPEN JET
R. Ross (National Aerospace Lab., Northeast Polder, Netherlands), J. W. G. vanNunen (National Aerospace Lab., Northeast Polder, Netherlands), K. J. Young (Boeing Commercial Airplane Co., Seattle, Wash.), R. M. Allen (Boeing Commercial Airplane Co., Seattle, Wash.), and J. C. A. vanDitshuizen 1983 102 p refs
(DNW-TR-82-03; D6-51501) Avail: NTIS HC A06/MF A01

The aerodynamic and acoustic quality of the German-Dutch Wind Tunnel open jet test section configuration was established. The flow quality is found to be excellent; for the core region angular deviations up to 0.1 deg, turbulence levels of 0.2% and dynamic pressure deviations of 0.5% are reported. Near the shear layer these values become higher. The anechoic quality meets reasonably high standards. The acoustic correction procedures for 1/3 octave analysis were checked. The usual shear layer correction has to be extended to correct for turbulence effects for high tunnel velocity, high frequency, and the most forward and the most rearward propagation angles from the sound source. This correction is independent of the position of the model in the flow and the type of sound source (tone or broadband). Author (ESA)

N86-16237# Duits-Nederlandse Windtunnel, Noordoostpolder (Netherlands).
ACOUSTIC EVALUATION OF THE GERMAN-DUTCH WIND TUNNEL (DNW) SHEAR LAYER CORRECTION USING A MODEL JET
W. H. Herkes (Boeing Commercial Airplane Co., Seattle, Wash.), F. G. Strout (Boeing Commercial Airplane Co., Seattle, Wash.), R. Ross (National Aerospace Lab., Northeast Polder, Netherlands), and J. C. A. vanDitshuizen 1983 140 p refs
(DNW-TR-82-04; D6-51502) Avail: NTIS HC A07/MF A01

Acoustic tests of a 6-cm model jet were conducted in the German-Dutch Wind Tunnel 6m by 8m free jet facility to evaluate a free jet shear layer correction procedure that adds an empirical correction to the previous theoretical correction. Static-flight effects on jet noise measured in the flow were used to evaluate the corresponding out-of-flow results. The experiment demonstrates that the procedure significantly improves the accuracy of the flight effects measured by the out-of-flow microphones. Comparisons of the out-of-flow free jet results to results obtained in closed wind tunnels and from aircraft flyovers show consistent trends. Author (ESA)

N86-16238# Duits-Nederlandse Windtunnel, Noordoostpolder (Netherlands).
AERODYNAMICAL CALIBRATION OF THE GERMAN-DUTCH WIND TUNNEL (DNW): A REVIEW OF TESTING TECHNIQUES AND RESULTS
Feb. 1983 7 p
(DNW-PA-82062) Avail: NTIS HC A02/MF A01

System checkout, performance measurement, and aerodynamical calibration of the German-Dutch Wind Tunnel are summarized. Mechanical and electrical system tests; flow quality measurements; static and dynamic performance assessment; temperature and pressure distribution measurement; and turbulence and spectral characteristics measurement are described. Author (ESA)

N86-16239# National Bureau of Standards, Gaithersburg, Md. Center for Building Technology.
PERFORMANCE REQUIREMENTS AND PRELIMINARY DESIGN OF A BOUNDARY LAYER WIND TUNNEL FACILITY Final Report
R. D. Marshall May 1985 68 p
(PB85-224418; NBSIR-85/3168) Avail: NTIS HC A04/MF A01 CSCL 14B

This report describes performance characteristics and design details of a boundary layer wind tunnel for suppporting research activities within the Center for Building Technology. Two preliminary designs, the first consisting of a conventional closed-circuit scheme in an over/under configuration and the second consisting of an open-circuit scheme with a pusher or blow-down configuration, are addressed. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N86-16240# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
COMPARISON OF ALTERNATIVE STRATEGIES OF RETURN TO THE MOON (CASTOR)
H. Hermann Koelle, Uwe Apel, and Bernd Johenning 10 Aug. 1985 40 p refs
(ILR-MITT-153) Avail: NTIS HC A03/MF A01

Strategies of constructing and supporting a permanent lunar base for 25 operational years with a crew of 6, 30, or 120 respectively were assessed. If initial development funding is available in 1991, beneficial occupancy of such lunar bases could occur in the 2001 to 2004 time bracket. The cost is estimated to

be on the order of 56, 65, and 106 billion 1985 $ respectively leading to a cost-effectiveness of 338, 83, and 33 million 1985 $ per lunar man-year for the alternatives. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N86-16241# Naval Surface Weapons Center, Dahlgren, Va.
DIFFERENTIAL CORRECTION OF ORBITS BY KEPLER VERSUS CARTESIAN PARAMETERS Final Report
C. H. Seay Dec. 1984 17 p
(AD-A157868; AD-F350035; NSWC/TR-85-17) Avail: NTIS HC A02/MF A01 CSCL 22/3

Numerical integration of orbits of near Earth satellites is usually carried out in a Cartesian Coordinate System. When performing the differential correction of an initial orbit to match observations, the parameters of the solution are sometimes the corrections to the position and velocity vector of the satellite at epoch. At the Naval Surface Weapons Center, however, the parameters chosen are Kepler parameters modified to avoid singularity for circular orbits. The rate of convergence for a sample case was not found to be significantly different for the two parameterizations, but a significant gain in numerical accuracy was obtained with the set of Kepler parameters. GRA

N86-16242# Lawrence Livermore National Lab., Calif.
HARMONICALLY EXCITED ORBITAL VARIATIONS
T. Morgan Aug. 1985 11 p refs Presented at the International Astronautical Federation Congress, Stockholm, Sweden, 7 Oct. 1985
(Contract W-7405-eng-48)
(DE85-017102; UCRL-93154; CONF-8510146-1) Avail: NTIS HC A02/MF A01

Rephrasing the equations of motion for orbital maneuvers in terms of Lagrangian generalized coordinates instead of Newtonian rectangular Cartesian coordinates can make certain harmonic terms in the orbital angular momentum vector more readily apparent. In this formulation the equations of motion adopt the form of a damped harmonic oscillator when torques are applied to the orbit in a variationally prescribed manner. The frequencies of the oscillator equation are in some ways unexpected but can nonetheless be exploited through resonant forcing functions to achieve large secular variations in the orbital elements. Two cases are discussed using a circular orbit as the control case: (1) large changes in orbital inclination achieved by harmonic excitation rather than one impulsive velocity change, and (2) periodic and secular changes to the longitude of the ascending node using both stable and unstable excitation strategies. The implications of these equations are also discussed for both artificial satellites and natural satellites. For the former, two utilitarian orbits are suggested, each exploiting a form of harmonic excitation. DOE

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N86-16651# Sandia National Labs., Albuquerque, N. Mex.
ULTRA-HIGH-VELOCITY IMPACTS UTILIZING A ROCKET SLED AND AN EXPLOSIVELY ACCELERATED FLYER PLATE
R. A. Benham and W. R. Kampfe *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 51-55 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/2

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-16243*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC AERODYNAMIC CHARACTERISTICS OF SOME REENTRY CONCEPTS FOR ANGLES OF ATTACK TO 90 DEG
M. Leroy Spearman Nov. 1985 32 p refs
(NASA-TM-87645; NAS 1.15:87645) Avail: NTIS HC A03/MF A01 CSCL 22B

Past studies of reentry vehicles tested to high angles of attack (up to 90 deg) in the Mach number range from 2 to 4.8 are reviewed. Two basic planforms are considered: highly-swept deltas and circular. The delta concepts include variations in cross section (and thus volume) and in camber distribution. The effectiveness of various types of aerodynamic control devices is also included. The purpose of the paper is to examine the characteristics of the vehicles with a view toward the potential usefulness of such concepts in a flight regime that would include reentry from space into the atmosphere followed by a transition to sustained atmospheric flight. Author

N86-16244# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF NECESSARY COMMANDS FOR THE MOTION OF A ROCKET ON A GIVEN LINEAR TRAJECTORY IN THE ATMOSPHERE
A. Codoban 27 Aug. 1985 23 p Transl. into ENGLISH from Studii si Cercetari de Mecanica Aplicata (Romania), v. 42, no. 3, May - Jun. 1983 p 223-239
(AD-A159352; AD-E700020; FTD-ID(RS)T-1271-84) Avail: NTIS HC A02/MF A01 CSCL 09/2

The variation in time of the attack angle of the control surfaces of a rocket so that it is moving on a given linear trajectory in the atmosphere is determined in this paper. Variation of aerodynamic coefficients with the Mach number is considered as well as the variation in time (in the fuel combustion stage) of the moments of inertia and the position of the center of mass of the rocket. Air density and sound velocity are assumed variable with the altitude. A numerical calculation example solved with the algorithm presented in this paper is shown in the end. Author (GRA)

N86-16245# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
PRESENTATION OF AEROSPATIALE'S LAUNCHER GUIDANCE METHODS [PRESENTATION DES METHODES DE PILOTAGE DE LANCEUR DE L'AEROSPATIALE]
J. Dupont 1985 15 p In FRENCH Presented at Journees Statist. Ind., Luminy, France, 28-30 Jan. 1985
(SNIAS-852-422-109) Avail: NTIS HC A02/MF A01

The mathematical model of a launcher based on Lagrange coordinates and a description of the guiding system based on a linear quadratic Gaussian synthesis (LQG) are discussed. It is shown that while LQG gives good results and robustness, there are problems to be solved, including the choice of a reduced model, the possibility of reducing the gain of the quadratic criteria or of the noise covariance, and saturation of commands.
Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N86-16246*# Martin Marietta Aerospace, Denver, Colo.
SPACE SHUTTLE PROGRAM SOLID ROCKET BOOSTER DECELERATOR SUBSYSTEM Final Report
James W. Barnard Sep. 1985 89 p
(Contract NA8-32122)
(NASA-CR-178576; NAS 1.26:178576; DR-MA-6; SRB-DSS-MA6) Avail: NTIS HC A05/MF A01 CSCL 22B

The recovery of the Solid Rocket Boosters presented a major challenge. The SRB represents the largest payload ever recovered and presents the added complication that it is continually emitting hot gases and burning particles of insulation and other debris. Some items, such as portions of the nozzle, are large enough to burn through the nylon parachute material. The SRB Decelerator Subsystem program was highly successful in that no SRB has been lost as a result of inadequate performance of the DSS.
G.L.C.

N86-16247# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
FIRST GERMAN SPACELAB MISSION D1 REPORTS [ERSTE DEUTSCHE SPACELAB-MISSION D1-REPORT]
Jun. 1985 7 p In GERMAN
Avail: NTIS HC A02/MF A01

The D1 Spacelab mission scientific space freight was dispatched from Bremen to the NASA Cape Canaveral launching site on a Boeing 747 freight and on a Lockheed C5A Galaxy. The Spacelab standard racks were integrated into the space laboratory (level 3 integration) and the payload elements to be exposed to space environment on the launcher structure. Simulations of the functions with the Columbia space shuttle were tested. Mission phases under flight conditions were tested in the integration hall at MBB-ERNO. Fluid shift under weightlessness was studied by measuring the eye's internal pressures with a tonometer.
Author (ESA)

N86-16248# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
MANNED FLIGHT SAFETY [SECURITE DU VOL HABITE]
Jean-Claude Crenenet (CNES, Evry, France) and Christine Macadre 1985 15 p In FRENCH Presented at 3rd Seminaire Europeen sur la Securite des Systemes, Cannes, France, 19-21 Sep. 1984 (SNIAS-852-422-106) Avail: NTIS HC A02/MF A01

An analysis for the development of the transfer functions necessary for space flight safety planning is presented. The study precedes the design of the material elements, based on an Ariane launching. The organization of the safety research team is discussed.
Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N86-16249*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF INTERSATELLITE LINKS TO DOMESTIC SATELLITE SYSTEMS
Denise S. Ponchak and Rodney L. Spence 1986 17 p refs Proposed for presentation at the 11th Communications Satellite Systems Conference, San Diego, Calif., 16-20 Mar. 1986; sponsored by AIAA
(NASA-TM-87215; E-2829; NAS 1.15:87215) Avail: NTIS HC A02/MF A01 CSCL 09F

The results of a study on intersatellite link (ISL) applications for domestic satellite communications are presented. It was determined if any technical, economic, or performance benefits could be gained by introducing intersatellite links into a domestic satellite communication network. Several key systems issues of domestic ISL's are addressed. These include the effect of a skewed traffic distribution on the selection of ISL satellite orbit locations, tolerable satellite spacing, and crosslink traffic-handling requirements. An ISL technology assessment is made by performing a parametric link analysis for several microwave and optical implementations. The impact of the crosslink on the end-to-end link performance is investigated for both regenerative and nonregenerative ISL architectures. A comparison is made between single satellite systems operating at C-, and Ku-bands and the corresponding ISL systems in terms of ground segment cost, space segment cost, and net link performance. Results indicate that ISL's can effectively expand the CONUS orbital arc, with a 60 GHz ISL implementation being the most attractive.
Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-16250*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DECOUPLED AND LINEAR QUADRATIC REGULATOR CONTROL OF A LARGE, FLEXIBLE SPACE ANTENNA WITH AN OBSERVER IN THE CONTROL LOOP
Harold A. Hamer, Katherine G. Johnson, and John W. Young Nov. 1985 74 p refs
(NASA-TP-2484; L-15913; NAS 1.60:2484) Avail: NTIS HC A04/MF A01 CSCL 22B

An analysis is performed to compare decoupled and linear quadratic regulator (LQR) procedures for the control of a large, flexible space antenna. Control objectives involve: (1) commanding changes in the rigid-body modes, (2) nulling initial disturbances in the rigid-body modes, or (3) nulling initial disturbances in the first three flexible modes. Control is achieved with two three-axis control-moment gyros located on the antenna column. Results are presented to illustrate various effects on control requirements for the two procedures. These effects include errors in the initial estimates of state variables, variations in the type, number, and location of sensors, and deletions of state-variable estimates for certain flexible modes after control activation. The advantages of incorporating a time lag in the control feedback are also illustrated. In addition, the effects of inoperative-control situations are analyzed with regard to control requirements and resultant modal responses. Comparisons are included which show the effects of perfect state feedback with no residual modes (ideal case). Time-history responses are presented to illustrate the various effects on the control procedures.
Author

N86-16251*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DYNAMIC MODELING AND ADAPTIVE CONTROL FOR SPACE STATIONS
Che-Hang Charles Ih and Shyh Jong Wang 15 Jul. 1985 301 p refs
(Contract NAS7-918)
(NASA-CR-176442; JPL-Pub-85-57; NAS 1.26:176442) Avail: NTIS HC A14/MF A01 CSCL 22B

Of all large space structural systems, space stations present

a unique challenge and requirement to advanced control technology. Their operations require control system stability over an extremely broad range of parameter changes and high level of disturbances. During shuttle docking the system mass may suddenly increase by more than 100% and during station assembly the mass may vary even more drastically. These coupled with the inherent dynamic model uncertainties associated with large space structural systems require highly sophisticated control systems that can grow as the stations evolve and cope with the uncertainties and time-varying elements to maintain the stability and pointing of the space stations. The aspects of space station operational properties are first examined, including configurations, dynamic models, shuttle docking contact dynamics, solar panel interaction, and load reduction to yield a set of system models and conditions. A model reference adaptive control algorithm along with the inner-loop plant augmentation design for controlling the space stations under severe operational conditions of shuttle docking, excessive model parameter errors, and model truncation are then investigated. The instability problem caused by the zero-frequency rigid body modes and a proposed solution using plant augmentation are addressed. Two sets of sufficient conditions which guarantee the globablly asymptotic stability for the space station systems are obtained. Author

N86-16252*# Alabama Univ., Huntsville.
ANALYSIS OF SATELLITE DRAG AND SPIN DECAY DATA Final Technical Report
Gerald R. Karr Sep. 1985 20 p
(Contract NAS8-35663)
(NASA-CR-178609; NAS 1.26:178609; UAH-456) Avail: NTIS HC A02/MF A01 CSCL 22A

Work was begun as an effort to obtain satellite drag and upper atmospheric wind data from a spinning spherical satellite to be launched from the space shuttle scheduled for the STS-11 flight. The satellite was an inflated sphere having high area-to-mass ratio which would result in measurable orbital decay due to aerodynamic drag forces experienced by the satellite in the Earth's upper atmosphere. The satellite would also experience a spin decay due to the aerodynamic torque acting to slow the satellite spinning. The original proposal was to develop data analysis procedures to be employed to extract the desired information. Work was performed concerning the data analysis procedure prior to the STS-11 launch; however, the major effort was to begin after the data had been obtained. Unfortunately, the launch of the inflatable sphere on STS-11 was a failure in that the sphere did not inflate properly and no data was obtained. The emphasis of the work planned under this effort was then changed to develop a proposal for a series of experiments similar to the one originally planned for STS-11. G.L.C.

N86-16253# Naval Surface Weapons Center, Dahlgren, Va.
SATELLITE DRAG PERTURBATIONS IN NONSINGULAR VARIABLES PRODUCED BY AN OBLATE DIURNAL ATMOSPHERE. PART 1: THEORY Final Report
A. D. Parks Oct. 1984 30 p
(AD-A157869; AD-F350036; NSWC/TR-84-353) Avail: NTIS HC A03/MF A01 CSCL 22/3

Analytic expressions are derived that describe the atmospheric drag induced decay rates for the semimajor axis and eccentricity for orbits of small eccentricity. The effects of both the oblate Earth figure and diurnal density variations are included in the development. Equations describing the effects of geopotential perturbations are also summarized. GRA

N86-16254# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
SPACECRAFT, STRAIGHT-TUBE EVAPORATOR DESIGN Final Report, 1 Jul. 1983 - 31 Mar. 1985
R. E. Eastman May 1985 85 p
(AF Proj. 240-2)
(AD-A158757; AFWAL-TR-85-3024) Avail: NTIS HC A05/MF A01 CSCL 13/1

Two-phase (liquid-vapor) heat transfer systems are being considered for use on future spacecraft cooling systems operating at high energy levels. The design of straight-tube evaporators was studied for this application. The forced convective boiling phenomenon was examined to determine the characteristics of boiling flow and possible effects of gravitational acceleration. Experiments with straight-tube evaporators indicated that pressure fluctuations caused by slug flow may hamper efforts to build two-phase cooling systems. Upstream orifices and twisted tape inserts were investigated to overcome this problem. A method was also developed to size an evaporator based on the best available correlation equations. Some errors were corrected for flow-boiling heat transfer equations found in the literature. GRA

N86-16255# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Dept. Essais Thermiques.
THE HIGH TEMPERATURE OXIDATING ATMOSPHERE TEST FACILITIES AT SNIAS [LES MOYENS D'ESSAIS HAUTE TEMPERATURE AMBIANCES OXYDANTES DE L'AEROSPATIALE]
Pierre Brunelot and Jean-Pierre Serranno 1985 22 p In FRENCH
(SNIAS-852-430-106; AQEE/T-7737/PB/MF) Avail: NTIS HC A02/MF A01

Facilities to test spacecraft heat shields are described. The reentry conditions are simulated by infrared radiation generators, arc image generators, and a plasma generator with an electrical power capacity of 42,000 KVA. The design of a second generation plasma generator and an oxygen controlled oxidating environment chamber are described. Prototypes are operational. Author (ESA)

N86-16639# General Electric Co., Philadelphia, Pa. Space System Div.
APPLICATION OF THE ITD ALGORITHM TO LANDSAT TRANSIENT RESPONSES
R. R. Kauffman *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 81-89 refs
(For primary document see N86-16632 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washingtonn, D.C. 20375 CSCL 22/2

N86-16643# Indian Space Research Organization, Bangalore. Structures Div.
LOW ORDER DYNAMIC MODELS OF INDIAN REMOTE SENSING SATELLITE
M. Sambasiva Rao, B. G. Prakash, and M. S. S. Prabhu *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 129-153 (For primary document see N86-16632 07-39)
Copyright. Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 22/2

N86-16654# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN UPDATE OF SPACECRAFT DYNAMIC ENVIRONMENTS INDUCED BY GROUND TRANSPORTATION
N. R. OConnell *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 77-85 refs
(For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N86-16256 Iowa Univ., Iowa City.
GEOCORONAL IMAGING WITH DYNAMICS EXPLORER Ph.D. Thesis
Richard Louis Rairden 1985 159 p
Avail: Univ. Microfilms Order No. DA8518866

The ultraviolet photometer of the University of Iowa spin-scan

auroral imaging instrumentation on board the Dynamics Explorer-1 satellite has returned numerous images of the geocorona from altitudes of 570 km to 23,300 km. The geocoronal emissions viewed arise from the resonant scattering of solar lyman-alpha radiation by the neutral hydrogen atoms which make up the Earth's tenuous exosphere. The geocoronal observations from 1981 through 1984 are compared to a spherically symmetric isothermal Chamberlain model of the exospheric density distribution. Model parameters are varied to obtain an acceptable fit. The radiative transfer equation is solved numerically for this multiple-scattering problem. Stellar intensities are monitored for inflight-calibration of the DE-1 instrument. The solar Ly alpha flux is estimated through concurrent measurements made by the SME satellite, supplemented by published values of ground observable solar indices. Dissert. Abstr.

N86-16257# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

SOME DESIGN CONSIDERATION ON A FAST, RELIABLE AND LOW-POWER MULTIPROCESSOR SYSTEM FOR IMAGE PROCESSING ON BOARD SCIENTIFIC SATELLITES

F. A. Gerritsen, A. Monkel, and H. F. A. Roefs 22 Nov. 1983 29 p refs Submitted for publication

(Contracts ESTEC-5047/82/NL-HP; NIVR-1987)

(NLR-MP-83071-U; B8568521) Avail: NTIS HC A03/MF A01

The design of an image compression and decompression system for use on board scientific satellites is discussed. The multiprocessor system is programmable with image compression/decompression algorithms to process image data at relatively high throughput rates with a relatively low power consumption. The system fits in a relatively small volume. Enhancement of the adaptability of the system to a range of scientific satellites is emphasized. Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-16258*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RELIABILITY AND MASS ANALYSIS OF DYNAMIC POWER CONVERSION SYSTEMS WITH PARALLEL OF STANDBY REDUNDANCY

Albert J. Juhasz and Harvey S. Bloomfield 1985 16 p ref Presented at the 2nd Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 14-16 Jan. 1985; sponsored by New Mexico Univ.

(NASA-TM-87189; E-2668; NAS 1.15:87189) Avail: NTIS HC A02/MF A01 CSCL 21F

A combinatorial reliability approach is used to identify potential dynamic power conversion systems for space mission applications. A reliability and mass analysis is also performed, specifically for a 100 kWe nuclear Brayton power conversion system with parallel redundancy. Although this study is done for a reactor outlet temperature of 1100K, preliminary system mass estimates are also included for reactor outlet temperatures ranging up to 1500 K. Author

N86-16259*# Little (Arthur D.), Inc., Cambridge, Mass.

LIQUID BELT RADIATOR DESIGN STUDY Final Report

W. P. Teagan and K. F. Fitzgerald Jan. 1986 53 p refs

(Contract NAS3-23889)

(NASA-CR-174901; NAS 1.26:174901) Avail: NTIS HC A04/MF A01 CSCL 22B

The Liquid Belt Radiator (LBR) is an advanced concept developed to meet the needs of anticipated future space missions. A previous study documented the advantages of this concept as a lightweight, easily deployable alternative to present day space heat rejection systems. The technical efforts associated with this study concentrate on refining the concept of the LBR as well as examining the issues of belt dynamics and potential application of the LBR to intermediate and high temperature heat rejection applications. A low temperature point design developed in previous work is updated assuming the use of diffusion pump oil, Santovac-6, as the heat transfer media. Additional analytical and design effort is directed toward determining the impact of interface heat exchanger, fluid bath sealing, and belt drive mechanism designs on system performance and mass. The updated design supports the earlier result by indicating a significant reduction in system specific system mass as compared to heat pipe or pumped fluid radiator concepts currently under consideration (1.3 kg/sq m versus 5 kg/sq m). Author

N86-16260# Los Alamos National Lab., N. Mex.

ANTI-MATTER PROPULSION: FEASIBILITY, STATUS AND POSSIBLE ENHANCEMENT

S. D. Howe 1985 13 p Presented at the Manned Mars Mission Workshop, Huntsville, Ala., 10 Jun. 1985

(Contract W-7405-eng-36)

(DE85-015716; LA-UR-85-2443; CONF-8506149-3) Avail: NTIS HC A02/MF A01

The possible use of advanced propulsion techniques must be considered if the currently envisioned launch date of the Manned Mars Mission were to be delayed until 2020 or later. Within the next 30 years, technological advances may allow such methods as beaming power to the ship, inertial-confinement fusion, or mass-conversion of antiprotons to become feasible. Of the possible methods, the antiproton (anti-p), reaction offers the highest potential, the greatest problems, and the most fascination. An Isp of 5000 s would allow the currently envisioned ship to fly to Mars in 3 months and would require about one million pounds to be assembled in Earth orbit. Antiprotons are currently being produced in the world in amounts of about 10 to the 14th power particles per year. With sufficient effort, almost a mg/yr could be produced by the early 2000s. Current experiments plan to decelerate and capture about 10 to the 10th power or greater antiprotons in an electrostatic Penning trap. Such traps may provide a source of low energy anti-p's for development of better storage mechanisms suitable for propulsion. Recently, proposals have been investigated which would amplify the average energy released per anti-p used. The proposals entail using the anti-p's to produce inertial confinement fusion of a capsule or to produce negative muons which can catalyze fusion. By increasing the energy released per anti-p, the effective specific cost, $/joule, can be reduced to attractive levels. These two proposals and other areas of research can be investigated now and will help in assessing the feasibility of an anti-p engine. DOE

N86-16261# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.

AGING OF ROCKET MOTORS

Anders Schwartz May 1985 32 p refs In SWEDISH; ENGLISH summary

(FOA-C-20573-D1(D3); ISSN-0347-3694) Avail: NTIS HC A03/MF A01

Storage effects on solid rocket propellants are discussed. Properties can change in such a way that the function of the motors can deteriorate. Physical and chemical aging can change the rheological properties of the propellants. At static firing of motors at different temperatures pressure and thrust were measured. When the propellant is case bonded, turning and cutting must be done in the motor case before test pieces can be made. Chemical aging may occur in double based propellants and in composite propellants. Data must be available on the temperature variations in the storage places; with the aid of these data, accelerated aging tests can be carried out at realistic temperatures, and to get a picture of how the propellant will change in the following years. Test methods were worked out and standardized. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-16262 National Physical Lab., Teddington (England). Div. of Quantum Metrology.
TEMPERATURE FIXED POINTS 2. BENZOIC ACID TRIPLE-POINT CELLS
M. F. Vaughan and J. Butler Feb. 1985 25 p refs
(NPL-QU-71; ISSN-0309-3050) Copyright. Avail: Issuing Activity

The need for temperature fixed points close to 120C is recalled. Since one of the secondary reference points listed in the International Practical Temperature Scale of 1968 is the triple point of benzoic acid 122.37C, a fixed point based on this compound was developed. The production and evaluation of such benzoic acid triple point cells are described. The results indicate that the triple point of benzoic acid is 122.365C, + or - 0.005C. Several of the cells produced have fixed point temperatures close to this value.
Author (ESA)

N86-16263 National Physical Lab., Teddington (England). Div. of Quantum Metrology.
TEMPERATURE FIXED POINTS 3. PURITY OF ORGANIC COMPOUNDS
M. F. Vaughan Jun. 1985 21 p refs
(NPL-QU-72; ISSN-0309-3050) Copyright. Avail: Issuing Activity

A method for determining the purities of compounds of organic triple point cells having fixed points with repeatabilities of + or - 0.001C to + or - 0.0001C is described. It is based on the lowering of the freezing point, and requires little supervision. When triple point conditions (i.e., in the absence of atmospheric pressure and dissolved air) are used, purities of 99.999% can be determined. The method is used to monitor procedures for the purification of ethylene carbonate, diphenyl ether, benzoic acid, benzene, phenol, icosane, and 4-nitrotoluene.
Author (ESA)

N86-16264# Pacific Northwest Lab., Richland, Wash.
ANALYSIS OF SEMI-VOLATILE ORGANIC COMPOUNDS USING SUPERCRITICAL FLUID METHODOLOGIES
B. W. Wright, E. K. Chess, C. R. Yonker, and R. D. Smith Jun. 1985 7 p Presented at the 5th Annual National Symposium on Recent Advances in the Measurement of Air Pollutants, Raleigh, N. C., 14 May 1985
(Contract DE-AC06-76RL-01830)
(DE85-016620; PNL-SA-13013S; CONF-850564-1) Avail: NTIS HC A02/MF A01

This study demonstrates the applicability of supercritical fluid chromatography (SFC) and analytical supercritical fluid extraction (SFE) for the analysis of semivolatile compounds. Mixtures of nitro-polycyclic aromatic hydrocarbons that are not ammenable to gas chromatography were separated using SFC with tentative compound identifications made by SFC-MS. Comparisons of analytical SFE of XAD-2 resin and NBS Urban Dust (SRM 1649) to conventional Soxhlet extraction are also discussed.
DOE

N86-16265# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
KINETICS OF THE REACTIONS BETWEEN CH2(X3B1)-RADICALS AND SATURATED HYDROCARBONS IN THE TEMPERATURE RANGE 296 TO 705 K
T. Boehland (Hungarian Academy of Sciences, Budapest), S. Dobe, F. Temps, and H. Gg. G. Wagner May 1985 37 p refs
(MPIS-11/1985; ISSN-0436-1199) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15

The kinetics of H-atom abstraction by 3CH2-radicals from saturated organic molecules is quantified. Experimental data for selected reactions of 3CH2 were analyzed to yield Arrhenius parameters for H-abstraction from different types of C-H bonds covering a wide range of bond energies. It is shown how the concurrent reactions of 1CH2 have to be taken into account. The results allow the prediction of rate constants for the reactions of 3CH2 with numerous reactants over a wide temperature range. They are especially useful for a separation of abstraction and addition channels in the reactions of 3CH2 with unsaturated hydrocarbons. The data obtained for the prototype radical CH2 contribute to the understanding of the chemistry of other carbenes.
Author (ESA)

N86-16266# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THE CONTRIBUTIONS OF INTERSYSTEM CROSSING AND REACTION IN THE REMOVAL OF CH2(a1A1) BY HYDROCARBONS STUDIED WITH LASER MAGNETIC RESONANCE (LMR)
T. Boehland, F. Temps, and H. G. G. Wagner May 1985 29 p refs Sponsored by Fonds der Chemie
(MPIS-10/1985; ISSN-0436-1199) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14

The formation of ground state CH2 (X 3B1)-radicals in the collisional removal of CH2 (a1A1) by selected hydrocarbons was studied in the gas phase at room temperature using Laser Magnetic Resonance (LMR). The radicals were generated by excimer laser photolysis of CH2CO at 308 nm in the presence of varying concentrations of RH. The yields of CH2 (X3B1) produced by intersystem crossing were measured with the LMR. Presuming the primary quantum yield for CH2 (X3B1) formation in the CH2CO photodissociation to be 0, the branching ratios for intersystem crossing were found. For values >0 the results have to be regarded as upper limits. Hence, for all hydrocarbons studied, reactive quenching is the dominating CH2 (a1A1) removal pathway.
Author (ESA)

24 COMPOSITE MATERIALS

Includes laminates.

N86-16267 Department of the Air Force, Washington, D.C.
CIRCUMFERENTIALLY WRAPPED CARBON-CARBON STRUCTURE Patent
G. A. Wallace and J. E. Zimmer, inventors (to Air Force) Issued 11 Jun. 1985 5 p Supersedes AD-D010974
(AD-D011904; US-Patent-4,522,883; US-Patent-Appl-SN-578335; US-Patent-Class-428-365) Avail: US Patent and Trademark Office CSCL 11/4

An improved carbon-carbon composite structure is described which consists essentially of a central core, a plurality of layers of circumferentially wrapped woven cotton fabric; and a carbon binder, wherein the central core consists essentially of a plurality of longitudinally oriented carbon fibers. There is also provided a method for fabricating an improved carbon-carbon nosetip preform for a reentry vehicle which consists essentially of providing at least one rigidized carbon rod to build up a desired thickness of fabric, impregnating the built-up structure with a suitable binder, carbonizing the binder and graphitizing the composite structure. There is further provided an apparatus for fabricating a nosetip preform which comprises a two-drum surface winder, one drum of which has a surface cover adapted to grip and propel a carbon fabric.
GRA

N86-16268*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTED TOMOGRAPHY FOR NON-DESTRUCTIVE EVALUATION OF COMPOSITES: APPLICATIONS AND CORRELATIONS
B. Goldberg, L. Hediger, and E. Noel Aug. 1985 51 p refs
(NASA-TM-86529; NAS 1.15:86529) Avail: NTIS HC A04/MF A01 CSCL 11D

The state-of-the-art fabrication techniques for composite materials are such that stringent species-specific acceptance criteria must be generated to insure product reliability. Nondestructive evaluation techniques including computed tomography (CT), X-ray radiography (RT), and ultrasonic scanning (UT) are investigated and compared to determine their applicability and

limitations to graphite epoxy, carbon-carbon, and carbon-phenolic materials. While the techniques appear complementary, CT is shown to provide significant, heretofore unattainable data. Finally, a correlation of NDE techniques to destructive analysis is presented. Author

N86-16269*# Bjorksten Research Labs., Inc., Madison, Wis.
DEVELOPMENT OF A CONTINUOUS SPINNING PROCESS FOR PRODUCING SILICON CARBIDE - SILICON NITRIDE PRECURSOR FIBERS Final Report
[1985] 43 p
(Contract NAS8-34648)
(NASA-CR-178458; NAS 1.26:178458) Avail: NTIS HC A03/MF A01 CSCL 11D

An apparatus was designed for the continuous production of silicon carbide - silicon nitride precursor fibers. The precursor polymer can be fiberized, crosslined and pyrolyzed. The product is a metallic black fiber with the composition of the type C sub x Si sub y n sub z. Little, other than the tensile strength and modulus of elasticity, is known of the physical properties. E.R.

N86-16270*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. Aerospace Technologies Div.
AUTOCLAVE PROCESSING FOR COMPOSITE MATERIAL FABRICATION. 1: AN ANALYSIS OF RESIN FLOWS AND FIBER COMPACTIONS FOR THIN LAMINATE Final Report
T. H. Hou Nov. 1985 33 p refs
(Contract NAS1-18000)
(NASA-CR-178011; NAS 1.26:178011) Avail: NTIS HC A03/MF A01 CSCL 11D

High quality long fiber reinforced composites, such as those used in aerospace and industrial applications, are commonly processed in autoclaves. An adequate resin flow model for the entire system (laminate/bleeder/breather), which provides a description of the time-dependent laminate consolidation process, is useful in predicting the loss of resin, heat transfer characteristics, fiber volume fraction and part dimension, etc., under a specified set of processing conditions. This could be accomplished by properly analyzing the flow patterns and pressure profiles inside the laminate during processing. A newly formulated resin flow model for composite prepreg lamination process is reported. This model considers viscous resin flows in both directions perpendicular and parallel to the composite plane. In the horizontal direction, a squeezing flow between two nonporous parallel plates is analyzed, while in the vertical direction, a poiseuille type pressure flow through porous media is assumed. Proper force and mass balances have been made and solved for the whole system. The effects of fiber-fiber interactions during lamination are included as well. The unique features of this analysis are: (1) the pressure gradient inside the laminate is assumed to be generated from squeezing action between two adjacent approaching fiber layers, and (2) the behavior of fiber bundles is simulated by a Finitely Extendable Nonlinear Elastic (FENE) spring. Author

N86-16271*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHORT-WAVELENGTH BUCKLING AND SHEAR FAILURES FOR COMPRESSION-LOADED COMPOSITE LAMINATES Ph.D. Thesis
Mark J. Shuart Nov. 1985 227 p refs
(NASA-TM-87640; NAS 1.15:87640) Avail: NTIS HC A11/MF A01 CSCL 11D

The short-wavelength buckling (or the microbuckling) and the interlaminar and inplane shear failures of multi-directional composite laminates loaded in uniaxial compression are investigated. A laminate model is presented that idealizes each lamina. The fibers in the lamina are modeled as a plate, and the matrix in the lamina is modeled as an elastic foundation. The out-of-plane w displacement for each plate is expressed as a trigonometric series in the half-wavelength of the mode shape for laminate short-wavelength buckling. Nonlinear strain-displacement relations are used. The model is applied to symmetric laminates having linear material behavior. The laminates are loaded in uniform end shortening and are simply supported. A linear analysis is used to determine the laminate stress, strain, and mode shape when short-wavelength buckling occurs. The equations for the laminate compressive stress at short-wavelength buckling are dominated by matrix contributions. Author

N86-16272# Lawrence Livermore National Lab., Calif.
EFFECTS OF THERMAL EXPOSURE ON THE STRUCTURAL AND MECHANICAL INTEGRITY OF GRAPHITE FIBERS
J. A. Hodson, L. J. Gregory, and R. J. Morgan 5 Jul. 1985 15 p Presented at the 17th SAMPE National Technical Conference on Materials, Kiamesha Lake, N.Y., 22 Oct. 1985
(Contract W-7405-eng-48)
(DE85-014948; UCRL-90944; CONF-851034-1) Avail: NTIS HC A02/MF A01

Three polyacrylonitrile-based (PAN-based) carbon fibers have been examined with respect to their strength degradation following elevated-temperature exposure. Fibers were heat-treated at temperatures of 12000 C, 15000 C, 2000 C, and 25000 C for 10, 20 and 30 minutes. The nitrogen concentration was found to follow an Arrhenius-type plot and an activation energy of 16.7 kJ. mol.K was found for nitrogen evolution in carbon fibers. The Thornel 300 fiber was found to degrade at high heat treatment temperatures in contrast to the Celion 6000 and IM6 fibers, which did not suffer any degradation in strength at all. DOE

N86-16273# Rolls-Royce Ltd., Derby (England). Non-Metallics Labs.
THE MATERIAL DEVELOPMENT, COMPONENT MANUFACTURE, AND POST-SERVICE EVALUATION OF RB211-524 COWL DOORS UTILIZING CARBON FIBRE COMPOSITE MATERIALS
G. A. Owens 23 Jul. 1985 24 p refs
(PNR-90275) Avail: NTIS HC A02/MF A01

A lightweight engine element including carbon fiber reinforced epoxy composite skin bonded to aluminum alloy honeycombs is described. Material selection, mechanical property data and evaluation of the material's environmental resistance are discussed. Corrosion resistance of the honeycomb construction is considered. The effect of the operating conditions is assessed in 6000 hr tests. No significant structural deterioration is exhibited.
Author (ESA)

N86-16274# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. Systemes Balistiques et Spatiaux.
MODELING OF TRANSIENT THERMAL TRANSFER IN ABLATIVE MATERIAL HEAT SHIELDING [MODELISATION DES TRANSFERTS THERMIQUES TRANSITOIRES DANS LES MATERIAUX DE PROTECTION THERMIQUE DEGRADABLES]
Ph. Pillois and A. Hordonneau 1985 11 p In FRENCH Presented at Club des Hautes Temp. Reunion, 24 Apr. 1985
(SNIAS-852-430-102) Avail: NTIS HC A02/MF A01

The design of heat shielding for civil or military space vehicles and its modeling and computerized simulation are discussed. The specifications of ablative materials are examined and three dimensional carbon fiber reinforced plastics are analyzed. The mechanisms of chemical and mechanical erosion are discussed. It is concluded that the choice of ablative heat shielding is linked to the type of mission, while the development of computerized models, manufacturing techniques, and test methods are essential to an efficient design. Author (ESA)

N86-16275# Societe Nationale Industrielle Aerospatiale, Paris (France).
STRUCTURE CHARACTERIZATION OF CARBON-CARBON COMPOSITES BY RAMAN MICROSPECTROMETRY [ETUDE DE LA STRUCTURATION DE COMPOSITES CARBONE-CARBONE A L'AIDE DE LA MICROSPECTROMETRIE RAMAN]
G. Rousseau 1985 13 p In FRENCH Presented at GFEC 85, 8-10 Sep. 1985
(SNIAS-852-430-108) Avail: NTIS HC A02/MF A01

Carbon-carbon composite raw materials, resulting composites

and their spectrometry are studied. The manufacturing procedure is described. A Microdil 28 spectrometer is used. Spectral resolution is 0.6 cm. The first order spectra are found in two distinct bands. The graphite composition may be deduced from it. It is shown that the crystal organization is a function of the original graphite raw material. Author (ESA)

N86-16276# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).
NONDESTRUCTIVE INSPECTION: AN EFFICIENT INVESTMENT [LE CONTROLE NON DESTRUCTIF: UN INVESTISSEMENT RENTABLE]
Francois Albugues 1985 13 p In FRENCH Presented at 4th Journees des Materiaux Composites, Bordeaux, France, 14-15 May 1985
(SNIAS-852-430-110) Avail: NTIS HC A02/MF A01

Nondestructive methods and their application to composite materials inspection in the aircraft industry are reviewed. The methods include visual control, dimension control, radiography, thermography, ultrasonics, acoustic analysis, holographic interferometry, optical microscopy, optoelectronics, and microanalysis. Author (ESA)

N86-16277# Societe Nationale Industrielle Aerospatiale, Paris (France).
ARENYL: A SOLUBLE MOLD TECHNOLOGY [ARENYL: UNE TECHNOLOGIE DE MANDRIN SOLUBLE]
Frederic Goffeney 1985 5 p In FRENCH Presented at 4th Journees des Materiaux Composites, Bordeaux, France, 14-15 May 1985
(SNIAS-852-430-111) Avail: NTIS HC A02/MF A01

Application of Arenyl to composite materials molding for the aircraft industry is described. Arenyl is composed of polyvinyl alcohol (PVA) and sand, has good mechanical properties and may be disaggregated by water solution of the PVA. It is concluded that Arenyl offers a good solution to molding problems. Aircraft element examples are given. Author (ESA)

N86-16278# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. Systemes Balistiques et Saptiaux.
STRUCTURAL DESIGN IN COMPOSITE MATERIALS [LOGICIEL DE CONCEPTIONS DE STRUCTURES BOBINEES]
Ph. Lalanne Apr. 1985 40 p refs In FRENCH Presented at Stage Calcul des Struct. en Materiaux Composites
(SNIAS-852-430-120) Avail: NTIS HC A03/MF A01

Computer aided design techniques are applied to structural design and illustrated by the case of a solid propellant ballistic missile second stage. The specifications and their translation in design parameters and computer program are discussed. The proposed system allows fast design changes and facilitates a finite element computation. The program details and the algorithms are analyzed. This automation of the design is shown to diminish consistently the design time and to increase its efficiency. Author (ESA)

N86-16279# Societe Nationale Industrielle Aerospatiale, Suresnes (France).
THE APPLICATIONS OF COMPOSITE MATERIALS IN THE AERONAUTICAL DOMAIN [LES APPLICATIONS DES COMPOSITES DANS LE DOMAINE AERONAUTIQUE]
G. Hellard, G. Hilaire, and M. Torres Apr. 1985 34 p in FRENCH
(SNIAS-852-551-103) Avail: NTIS HC A03/MF A01

The physical properties and the applications of composite materials to aircraft construction are described. Kevlar, carbon, and glass fiber properties are compared. Weight reduction and cost reduction are examined. Composite elements used in aircraft are described. Author (ESA)

N86-16280# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
AN OVERVIEW OF THE COMPUTER AIDED DESIGN AND MANUFACTURE OF ADVANCED COMPOSITES
J.-C. Leon and G. M. Wells Feb. 1985 25 p
(AERE-R-11665) Avail: NTIS HC A02/MF A01

A computer aided design and manufacturing system for filament winding complex shaped fiber composite components has been developed and demonstrated. The basis of the system is a commercial 3-D surface modeller called Syatrid with which in-house application software has been integrated. The application software allows the definition and display of geodesic trajectories on the surface of a Systrid generated object and the generation of control data to enable a numerically controlled filament winding machine to place fiber along the chosen path. DOE

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-16281 Georgia Inst. of Tech., Atlanta.
NEW METHODS OF SUBLAMINATE ANALYSIS FOR COMPOSITE STRUCTURES AND APPLICATIONS TO FRACTURE PROCESSES Ph.D. Thesis
Erian Abdelmessh Armanios 1985 259 p
Avail: Univ. Microfilms Order No. DA8516405

Laminated composite structures exhibit mechanical properties which vary with orientation and have a variety of failure modes. Simple analytical models that include the essential modes of deformation exhibited by a laminated composite structure and are suitable to investigate their failure response are developed. The models are developed using an intuitive engineering approach and a modified Donnell Approach. The models are applied to selected practical configurations such as a compression specimen reinforced with end tabs. The analysis and design of a symmetric double cracked-lap-shear specimen provides insight into the delamination failure of laminated composite structures and engineering design data. A new look at energy release rate computations based on the crack closure method is presented and a new singular fitting method based on the finite element data is proposed. Dissert. Abstr.

N86-16282 Pennsylvania State Univ., University Park.
IMPLICATION OF LAMINAR FLAME STABILITY ON IGNITION OF COMBUSTIBLE GASES BY LINE HEAT SOURCES Ph.D. Thesis
Ming-Ming Yan 1985 192 p
Avail: Univ. Microfilms Order No. DA851122

The limiting ignition criterion based on the blow off limit of laminar flames stabilized in the wake or plume of line heat sources is examined. The effect of geometry of the heat source and the effect of free stream velocities on ignition limits are also considered. The results are relevant to problems of flame stabilization in combustors as well as the initiation of accidental fire and explosion. The theoretical analysis involves solution of the nonsimilar boundary layer equations for an ideal gas with a one step reaction while neglecting radiation. A deflagration wave is always stabilized at some point downstream of the source for these assumptions, but its position often shifts rapidly from near to far from the source over a limited range of reaction parameters. Measurements of the stabilization distance of laminar flames for three different wire sizes implies the flame stabilization above a heated wire is mainly due to the thermal effect and not a hydrodynamic effect. As the blow off limit is approached, a very small change of the source strength can result in the blow off of the flame. This trend is in agreement with the laminar wake/plume analysis. Dissert. Abstr.

N86-16283# National Bureau of Standards, Washington, D.C. Center for Fire Research.
AN EXPLORATION OF COMBUSTION LIMITATIONS AND

ALTERNATIVES TO THE NBS TOXICITY TEST METHOD
Barbara C. Levin, Vytenis Babrauskas, Emil Braun, Joshua Gurman, and Maya Paabo Nov. 1985 90 p refs Sponsored in part by the US Consumer Product Safety Commission
(NBSIR-85-3274) Avail: NTIS HC A05/MF A01

Some limitations and potential limitations of the NBS toxicity screening test method had been identified in earlier work. These limitations have now been explored in greater detail. Also investigated is an alternative combustion system, consisting of a radiant cone heater, identical to the one in the recently developed Cone Calorimeter, an enclosed combustion chamber, and a slightly revised variant of the animal chamber. The new animal chamber is so constructed that, prior to the insertion of the animals, it could be evacuated and then back-filled with a desired sampling of the combustion products. The radiant combustion system showed a different mix of capabilities and limitations compared to the cup furnace combustor in the existing test method. In the present project, the more detailed assessment of the cup furnace operation leads to the recommendation that there is no single, universally preferable combustion environment, but that the cup furnace is adequate for the intended purpose of providing toxicity screening. Author

N86-16284# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
INFRARED SPECTROSCOPY OF SINGLE AEROSOL PARTICLES
S. Arnold (Polytechnic Institute of N.Y., Brooklyn) and A. B. Pluchino 12 Dec. 1985 32 p refs
(ATR-85(8463)-1) Avail: NTIS HC A03/MF A01

A means is described for obtaining the infrared absorption spectrum of a single aerosol particle by photothermal modulation of visible scattered light near a structure resonance (structure resonance modulation spectroscopy). Author

N86-16285# State Univ. of New York at Buffalo, Amherst. Dept. of Chemistry.
ELECTROCHEMISTRY AT VERY SMALL ELECTRODES Final Report, 1 Jul. 1979 - 31 Mar. 1985
R. A. Osteryoung and J. G. Osteryoung Sep. 1985 8 p
(Contract N00014-79-C-0682)
(AD-A159368) Avail: NTIS HC A02/MF A01 CSCL 07/4

Work was carried out in three areas: (1) correlation of spectroscopy with the results of electrochemical experiments ion ionic liquids (molten salts); (2) studies of cathodic stripping voltammetry, primarily at silver electrodes studies of the behavior of microelectrodes; and (3) electrodes with micron dimensions. Results are summarized, primarily with reference to Technical Reports and journal publication. Author (GRA)

N86-16286# California Univ., Los Angeles.
ANALYSIS OF THE ABSORPTION SPECTRUM OF NEODYMIUM: SODIUM BETA ALUMINA
A. J. Alfrey, O. M. Stafsudd, B. Dunn, D. L. Yang, and L. Salmon Sep. 1985 29 p
(Contract N00014-83-K-0498)
(AD-A159437; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/2

Through an analysis of the absorption spectrum of Nd(3+) : Na Beta Alumina and derivation of Judd/Ofelt parameters, a model for the nearest neighbor crystal field of the Nd(3+) ion has been developed. The proposed model indicates that residual sodium in partially exchanged samples is responsible for distorting the symmetric orientation of conduction plane oxygen. This in turn induces a shift in the Nd ion within a sixfold symmetric arrangement of oxygen ions thereby inducing a linear field term in the crystal field parameters. This is responsible for the anomalous absorption strength in ND(3+) : Na Beta Alumina. Author (GRA)

N86-16287# Department of Energy, Washington, D. C.
SPOT TEST FOR 1,3,5-triamino-2,4,6-trinitrobenzene, TATB Patent Application
B. W. Harris, inventor (to DOE) (Los Alamos National Lab., N. Mex.) Filed 29 Nov. 1984 8 p
(Contract W-7405-eng-36)
(DE85-017725; US-Patent-Appl-SN-676149) Avail: NTIS HC A02/MF A01

A simple, sensitive and specific spot test for 1,3,5-triamino-2,4,6-trinitrobenzene, TATB, is described. Upon the application of the composition of matter of the subject invention to samples containing in excess of 0.1 mg of this explosive, a bright orange color results. Interfering species such as TNT and Tetryl can be removed by first treating the sample with a solvent which does not dissolve the TATB, but readily dissolves these interfering explosives. DOE

N86-16288# Los Alamos National Lab., N. Mex.
EXPERIMENTAL STUDIES OF ACTINIDES IN MOLTEN SALTS
J. G. Reavis Jun. 1985 41 p refs
(Contract W-7405-eng-36)
(DE85-015368; LA-10340) Avail: NTIS HC A03/MF A01

This review stresses techniques used in studies of molten salts containing multigram amounts of actinides exhibiting intense alpha activity but little or no penetrating gamma radiation. The preponderance of studies have used halides because oxygen-containing actinide compounds (other than oxides) are generally unstable at high temperatures. Topics discussed here include special enclosures, materials problems, preparation and purification of actinide elements and compounds, and measurements of various properties of the molten volts. Property measurements discussed are phase relationships, vapor pressure, density, viscosity, absorption spectra, electromotive force, and conductance. DOE

N86-16289# Oak Ridge National Lab., Tenn.
COMMENTS ON OPTIMIZATION
C. K. Bayne 1985 8 p Presented at the Chemometrics Research Conference, Gaithersburg, Md., 20 May 1985
(Contract DE-AC05-84OR-21400)
(DE85-017085; CONF-850574-1) Avail: NTIS HC A02/MF A01

Comments are made on Dr. S. N. Deming's paper on optimization in analytical chemistry. Optimization applications, strategies for screening experiments, and steepest ascent method are discussed. DOE

N86-16290# Sandia Labs., Albuquerque, N. Mex.
TIME-RESOLVED INFRARED SPECTRAL PHOTOGRAPHY STUDIES OF SHOCK-INDUCED CHEMISTRY IN CS2
A. M. Renlund, S. A. Sheffield, and W. M. Trott 1985 5 p refs Presented at American Physical Society Topical Conference on Shock Waves in Condensed Matter, Spokane, Wash., 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-016132; SAND-85-0511C; CONF-850736-53) Avail: NTIS HC A02/MF A01

Experiments using time-resolved infrared spectral photography (TRISP) in the 6 to 8.5 (MU)m range to study explosively driven shocks in liquid CS2 are described. In this range, the temporal resolution of the TRISP system is < 1 ns. We have shown that single-shot infrared absorption studies in shocked liquids are feasible with this technique; however, well-controlled planar shocks appear to be necessary for clear interpretation of dynamic spectral changes. DOE

N86-16291# Rockwell International Corp., Golden, Colo.
RECENT CHEMICAL RESEARCH PROJECTS IN PYROCHEMISTRY
J. L. Long 29 Apr. 1985 19 p Presented at the 9th Annual Actinide Separations Workshop, Richland, Wash., 22 May 1985
(Contract DE-AC04-76DP-03533)
(DE85-013215; RFP-3824; CONF-8505139-6) Avail: NTIS HC A02/MF A01

The purpose is to create, define parametric limits for, and transfer to the Pyrochemical Development group a pyrochemical (electrochemical) process for the recovery of spent anodes from plutonium electrorefining. The basis for this endeavor is the idea of modifying the character of spent anodes to obtain and maintian a liquid state during continued electrolytic depletion of plutonium. There are many alloying agents or combinations of alloying agents

which could be added. The one chosen for the initial work was gallium because of its low melting point and low vapor pressure. From the Pu-Ga phase diagram, a composition of approximately 78 atomic percent gallium (50 weight percent) was chosen for the first solubilization experiment. One hundred grams each of spent anode and gallium were heated under 490 grams of NaCl-KCl-MGCl2 to 740 C, held for one hour and stirred for one hour. Examination of the microstructure of the resultant cooled mixture indicated that 90% of the surface was a single phase containing near-equal concentrations of plutonium and gallium. The microstructure also contained inclusions of various impurities. DOE

N86-16292# Los Alamos National Lab., N. Mex.
USE OF ELECTRICAL CONDUCTIVITY EXPERIMENTS TO STUDY THE PHASE DIAGRAM OF CARBON
A. C. Mitchell, J. W. Shaner, and R. N. Keeler 1985 12 p Presented at the 10th High Pressure Conference on Research in High Pressure Science and Technology, Amsterdam, Netherlands, 8 Jul. 1985
(Contract W-7405-eng-36)
(DE85-015718; LA-UR-85-2440; CONF-850759-10) Avail: NTIS HC A02/MF A01

Recent theoretical and experimental work on the properties of carbon at very high pressures indicates that the diamond phase may dominate the carbon phase diagram. The work of Yin and Cohen indicates that diamond may be the stable carbon phase to pressures as high as 20 Mbar. Recent work by Shaner, et al., is compatible with solid diamond on the Hugoniot at pressures up to 1.4 Mbar. Using previously developed techniques, we have carried out conductivity measurements on shock-compressed graphite to pressures in excess of 600 kbar and temperatures up to 5000 K. No diamond - liquid transition was observed under the experimental conditions achieved. DOE

N86-16293# Mound Lab., Miamisburg, Ohio.
METALLOGRAPHY OF TITANIUM BORIDE
C. S. Gustin and M. D. Kelly 1985 13 p Presented at the International Metallographic Society Conference, Denver, Colo., 21 Jul. 1985
(Contract DE-AC04-76DP-00053)
(DE85-016450; MLM-3281(OP); CONF-850753-5) Avail: NTIS HC A02/MF A01

Combustion synthesis is a self-propagating, high temperature thermal reaction which forms compounds from the component powders. Titanium and boron powders are reacted to form titanium boride compounds by this process. The extreme hardness of titanium boride and the need to resolve the microstructure for image analysis required special metallographic techniques. These special techniques and some of the resulting microstructural analysis are discussed. DOE

N86-16294# Los Alamos National Lab., N. Mex.
COHERENT ANTI-STOKES RAMAN SCATTERING IN BENZENE AND NITROMETHANE SHOCK-COMPRESSED TO 10 GPa
S. C. Schmidt, D. S. Moore, J. W. Shaner, D. L. Shampine, and W. T. Holt 1985 13 p refs Presented at the 10th High Pressure Conference on Research in High Pressure Science and Technology, Amsterdam, Netherlands, 8 Jul. 1985
(Contract W-7405-eng-36)
(DE85-015682; LA-UR-85-2330; CONF-850759-11) Avail: NTIS HC A02/MF A01

The frequency shifts of the ring-stretching mode of shock-compressed liquid benzene and the CN stretching mode of nitromethane have been measured using coherent anti-Stokes Raman scattering. Shock pressures up to 11 GPa were achieved using a two-stage light gas gun. The frequency shifted Raman signal was generated using single pulse Nd:YAG and broadband-type lasers. DOE

N86-16295# Los Alamos National Lab., N. Mex.
SPECTROSCOPIC STUDIES OF CARBON DISULFIDE AT HIGH PRESSURE
S. F. Agnew, B. I. Swanson, and D. G. Eckhart 1985 10 p refs Presented at the American Physical Society Topical Conference on Shock Waves in Condensed Matter, Spokane, Wash., 22 Jul. 1985
(Contract W-7405-eng-36)
(DE85-015725; LA-UR-85-2410; CONF-850736-52) Avail: NTIS HC A02/MF A01

The authors have identified the pressure for the onset of CS2 chemistry at ambient temperature and have correlated it with the several other indicators of increasing electronic interaction. They further explained the rather small shift of v1 and v3 with pressure as due to compensating effects of intermolecular repulsion and electronic ground-state mixing. Their measurement of the UV absorption edge with pressure matches that measured in an isothermal ramp shock and they have been able to estimate tne temperature of a step shock at 2.4 GPa as well. There are further indications of various molecular and polymer species present as a result of their infrared work and the relative amounts of these species are affected by the temperature, pressure, and physical state of the CS2. DOE

N86-16296# Oak Ridge National Lab., Tenn. Atomic, Molecular and High Voltage Physics Group.
ISOTOPIC DEPENDENCES OF THE DIELECTRIC STRENGTH OF GASES: NEW OBSERVATIONS, CLASSIFICATION AND POSSIBLE ORIGINS
L. G. Christophorou, E. Rodrigo, E. Marode (Ecole Superieur d'Electricite, Gif-sur-Yvette, France), and F. Bastien (Ecole Superieur d'Electricite, Gif-sur-Yvette, France) 1985 4 p refs Presented at conference
(Contract DE-AC05-84OR-21400)
(DE85-017077; CONF-850979-2) Avail: NTIS HC A02/MF A01

The finding that the CH4/CD4 nonuniform field behavior is polarity dependent (i.e., the V sub s (dc breakdown voltage) of CD4 is lower than that of CH4 for negative polarity, just the opposite of that for positive polarity) is reported. The origins of the observed isotope effects and predicted new isotopic dependences of V sub s are discussed. The results on the V sub s of H2S and D2S for negative polarity are reported, confirming their predicted behavior. This suggests that the isotopic dependences of the V sub s of gases are apparently of more general occurence than hitherto recognized. Author

N86-16297# Oak Ridge National Lab., Tenn. Chemical Technology Div.
THE AQUEOUS CHEMISTRY OF IODINE
L. M. Toth, K. D. Pannell, and O. L. Kirkland 1984 11 p refs Presented at conference
(Contract DE-AC05-84OR-21400)
(TI85-016384; CONF-840701-28) Avail: NTIS HC A02/MF A01

The chemistry of iodine has been examined in aqueous solutions of pH 6 to 10 containing 2500 ppm boron as H3BO3 at temperatures up to 150C using absorption spectrophotometry to identify and monitor the iodine species present. Kinetic rate constants for the disproportionation of the HOI intermediate, 3HOI = IO3 - + 2I(-) + 3H(+), are measured as a function of pH even though no direct spectral evidence for HOI itself has been observed. An HOI partition coefficient $>10,000$ is estimated; results of ionic strength tests are consistent with HOI being present as an uncharged triatomic species in solution. Redox and radiation effects on the aqueous iodine chemistry are also described. Author

N86-16298# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
THE ROLE OF TRANSITION METALS IN OXY-RADICAL INDUCED OXIDATION PROCESSES IN BIOLOGICAL SYSTEMS
Benon H. J. Bielski and Diane E. Cabelli 1985 6 p Presented at conference
(Contract DE-AC02-76CH-00016; Grant NIH-R01-GM23656-09)
(DE85-017517; BNL-36893; CONF-8509146-1) Avail: NTIS HC A02/MF A01

Some recent work is described and it is discussed in view of the roles ascribed to transition metals in oxidative processes

involving active oxygen species. Some of these oxidative processes are suspected to occur in living systems where they can lead to deleterious effects. Therefore, great efforts have gone into the study of fundamental reactions/mechanisms believed capable of either initiating or, conversely, suppressing the initiation (superoxide dismutases, catalase, antioxidants, etc.) of such events. The nature and role of superoxide-driven Fenton chemistry in biological systems is considered. The reactivity of transition metal cations in higher oxidation states with biological compounds is also examined. Author

N86-16299# California Univ., Berkeley. Lawrence Berkeley Lab.
SEMICLASSICAL METHODS IN CHEMICAL DYNAMICS
W. H. Miller Mar. 1985 21 p refs Presented at the Symposium on Semiclassical Descriptions of Atomic and Nuclear Collisions, Copenhagen, Denmark, 25 Mar. 1985
(Contract DE-AC03-76SF-00098)
(DE85-014527; LBL-19687; CONF-850376-4) Avail: NTIS HC A02/MF A01

A general semiclassical (multidimensional WKB-type) approximation to quantum mechanics is reviewed. The principal feature of the approach is that it is able to incorporate the exact classical mechanics of the system and also the quantum principle of superposition. Applications to inelastic and reactive scattering, and to statistical mechanics and reaction rates are discussed. DOE

N86-16300# Union Carbide Corp., Tarrytown, N.Y. Molecular Sieve Dept.
IMPROVED CATALYSTS FOR LIQUID HYDROCARBON FUELS FROM SYNGAS Technical Progress Report, Apr. - Jun. 1985
1985 476 p
(Contract DE-AC22-84PC-70028)
(DE85-015537; DOE/PC-70028/T3) Avail: NTIS HC A21/MF A01

The objective of the contract is to consolidate the advances made during the previous contract in the conversion of syngas to motor fuels using Molecular Sieve-containing catalysts and to demonstrate the practical utility and economic value of the new catalyst/process systems with appropriate laboratory runs. Work on the program is divided into the following six tasks: (1) preparation of a detailed work plan covering the entire performance of the contract; (2) preliminary techno-economic assessment of the UCC catalyst/process system; (3) optimization of the most promising catalysts developed under prior contract; (4) optimization of the UCC catalyst system in a manner that will give it the longest possible service life; (5) optimization of a UCC process/catalyst system based upon a tubular reactor with a recycle loop; and (6) economic evaluation of the optimal performance found under Task 5 for the UCC process/catalyst system. Accomplishments are reported for Tasks 2 through 5. DOE

N86-16301# Utah Univ., Salt Lake City. Dept. of Chemistry.
LIGAND INTERMEDIATES IN METAL CATALYZED CO REDUCTION Final Technical Report, 1 Jul. 1982 - 30 Jun. 1985
J. A. Gladysz 1985 24 p
(Contract DE-AC02-82ER-13005)
(DE85-017047; DOE/ER-13005/1) Avail: NTIS HC A02/MF A01

The principal goal of this project is the preparation and physical and chemical characterization of stable complexes containing reactive ligand types believed to be intermediates in metal catalyzed CO and CO2 reduction. We report on: (1) the chemistry of formyl complexes; (2) synthesis and reactivity of (ALPHA)-hydroxyalkyl complexes; (3) synthesis and chemistry of formaldehyde complexes; (4) chemistry of formate complexes; (5) synthesis and crystal structure of a stable =CH2 complex; (6) coupling of coordinated =CH2 to H2C=CH2; (7) (ALPHA) vs (BETA) hydride abstraction in metal alkyls; (8) stereochemistry of (ALPHA)-hydride abstraction; (9) alkylidene to olefin rearrangements; (10) syntheses of acetylide and vinylidene (C2) complexes; and (11) acid/base chemistry of metal hydrides. DOE

N86-16302# Wisconsin Univ., Madison.
MECHANISTIC STUDIES RELATED TO THE METAL CATALYZED REDUCTION OF CARBON MONOXIDE TO HYDROCARBONS Final Report, 1 Apr. 1977 - 30 Jun. 1985
C. P. Casey Feb. 1985 26 p refs
(Contract DE-AC02-77ER-04222)
(DE85-017049; DOE/ER-04222/6) Avail: NTIS HC A03/MF A01

Studies of compounds related to proposed intermediates in the hydrogenation of carbon monoxide over homogeneous and heterogeneous catalysts have been carried out. The synthesis, structure, and reactions of metal formyl compounds have been investigated. The synthesis and desproportionation reactions of hydroxymethyl metal compounds have been explored. Reactions involving interconversion of n(5)- and n'-C5H5 organometallic compounds have been discovered. New synthetic routes to bimetallic compounds with bridging hydrocarbon ligands have been developed. The first bimetallic compound with a budging CH ligand has been prepared. The hydrocarbation reaction in which the CH bond of a bridging methylidyne complex adds across a carbon-carbon double bond has been discovered. New heterobimetallic compounds linked by a heterodifunctional ligand and heterobimetallic compounds with directly bonded early and late transition metals have been synthesized in a search for new CO hydrogenation catalysts. DOE

N86-16303# Illinois Univ., Chicago.
KINETICS OF ELEMENTARY ATOM AND RADICAL REACTIONS Progress Report
R. J. Gordon Aug. 1985 10 p
(Contract DE-AC02-77ER-04426)
(DE85-017167; DOE/ER-04426/8) Avail: NTIS HC A02/MF A01

Our research program is concerned with the rates and mechanisms of elementary gas phase reactions and energy transfer involving polyatomic molecules. We report here on three ongoing projects: (1) the reaction of oxygen atoms with hydrogen molecules; (2) the chemistry of NH radicals; (3) and the vibrational relaxation of highly excited SF6 molecules. DOE

N86-16304# Minnesota Univ., St. Paul. Dept. of Chemistry.
ELECTROCHEMICAL HYDROGENATION AND HYDROGENOLYSIS IN AQUEOUS MEDIA Annual Report, 1985
E. Kariv-Miller 1985 10 p
(Contract DE-RA22-84PC-70754)
(DE85-017208; DOE/PC-70754/T1) Avail: NTIS HC A02/MF A01

Studies with anthracene, phenanthrene and benzothiophene demonstrate that Birch like cathodic reduction of polycyclic aromatics is possible and good yields of highly reduced products are obtained. Two distinctive advantages of the cathodic method are that, as compared to solvated electron reductions, it uses water as the solvent and the hydrogen source, and that the product composition can be controlled by the amount of charge transferred. In addition to the convenient conditions, the results obtained with benzothiophene indicate that the cathodic reduction or reductive cleavage when both are possible reaction routes for a substrate. DOE

N86-16305# Brigham Young Univ., Provo, Utah. Dept. of Chemistry.
SUPERCRITICAL FLUID CHROMATOGRAPHY/SUPERSONIC JET SPECTROSCOPY Progress Report, 1 May 1985 - 31 Jul. 1985
M. L. Lee and S. R. Goates 1985 10 p
(Contract DE-FG22-83PC-60807)
(DE85-017241; DOE/PC-60807/T1) Avail: NTIS HC A02/MF A01

The flame ionization detector (FID) added during the last period was replaced with a new FID was installed directly on the extractor oven. Instead of using the usual aluminum heating block, heating tape was wrapped around the FID, allowing temperatures in excess of 450C to be reached. In addition, with the new FID, the capillary restrictor could be inserted to the tip of the jet, avoiding hot metal surfaces which were causing peak tailing and adsorption. However, with the restrictor at the base of the detector flame, the higher flow rates at higher pressures (> 95 atm) extinguished the flame.

This problem was alleviated by dropping the restrictor to several centimeters below the tip of the jet. With this arrangement, the column effluent was heated somewhat before entering the flame. Apparently, not the high flow rates, but the high degree of cooling of the CO2 was the reason the flame was extinguished. A number of stationary phases in the form of column packing materials were evaluated for their suitability for the chemical class separation of aliphatics, olefins, and aromatics. DOE

N86-16306# EIC, Inc., Norwood, Mass.
CATALYSIS OF DIRECT METHANOL ELECTRO-OXIDATION IN BUFFERED ELECTROLYTES Annual Technical Progress Report, 15 Jul. 1984 - 14 Jul. 1985
M. W. Rupich, S. B. Brummer, D. A. Galligan, and S. C. Kingsley Jun. 1985 41 p
(Contract DE-AC02-83ER-13066)
(DE85-017388; DOE/ER-13066/2) Avail: NTIS HC A03/MF A01

The development of a methanol-air fuel cell is studied. A detailed evaluation of concentrated aqueous K2CO3 solutions as the electrolyte is performed. The work presented here involves the electro-oxidation of methanol in the electrolyte with various potential electrocatalysts. DOE

N86-16307# California Univ., Berkeley. Lawrence Berkeley Lab.
ADSORPTION OF ENERGY IN PHOTOCATALYTIC REACTORS
G. A. Somorjai Jul. 1985 41 p Presented at the Fundamentals and Developments of Photocatalytic and Photoelectrochemical Processes Course, Erice, Italy, 20 May 1984
(Contract DE-AC03-76SF-00098)
(DE85-017639; LBL-17824; CONF-840571-1) Avail: NTIS HC A03/MF A01

The dissociation of water to hydrogen and oxygen requires energy delta G sub 298 = 228 kJ/mole. By irradiating a semiconductor with light of energy greater than this amount, one may produce electrons in the excited state and electron vacancies at the surface that can perform the photochemical reduction (2H(+) + 2e(-) YIELDS 2H YIELDS H2) and oxidation (2OH(-) + 2(+) YIELDS H2O2 YIELDS H2O + (1/2)O2). There are several semiconductors, SrTiO3, TiO2, CdS, and Fe2O3 among them, that can photodissociate water. Some possess sites for both reduction and oxidation, while others carry out the two processes at different surfaces. A reversible solid state reaction that involves changes in the transition metal and ion oxidation state must accompany the splitting of water. Platinum, rhodium, and ruthenium oxide, when deposited on the semiconductor, serve as catalysts that accelerate the water photodissociation. These additives accelerate the recombination of hydrogen and oxygen atoms, shift the semiconductor Fermi level to a more favorable position that improves the thermodynamic feasibility for the process, accelerate electron transport, and inhibit side reactions like the photoreduction of oxygen. Many of the elementary reaction steps leading to photoproduction of hydrogen and oxygen over SrTiO3 and Fe2O3 have been identified and will be discussed. DOE

N86-16308# Argonne National Lab., Ill.
EFFECT OF SWIRL ON THE DEVELOPMENT OF RECIRCULATION FLOW PATTERNS IN A SWIRL COMBUSTOR
U. S. Choi, G. F. Berry, and T. R. Johnson 1985 22 p refs Presented at the American Society of Mechanical Engineers Winter Annual Meeting, Miami, Fla., 17 Nov. 1985
(Contract W-31-109-eng-38)
(DE85-012105; CONF-851125-6) Avail: NTIS HC A02/MF A01

The development of flow patterns is of great interest in combustion applications because an understanding of many aspects of the combustion process can be realized from fluid flow considerations alone. For example, the importance of recirculating flows in promoting flame stability and combustion intensity and the effect of swirl on slag capture in a slagging combustor have been demonstrated. However, in order to accurately predict flow patterns in actual combustors, it is necessary to properly model the complicated three-dimensional geometry of the combustors. Although most existing coal combustor codes may have very sophisticated models of chemical reactions, turbulence, and heat/mass transfer in multiphase environments, they do not have the capability to model complex combustor geometry, which seriously limits the usefulness of the codes in predicting actual flow patterns in the combustor. In this paper, a swirl combustor with complex air input louvres has been modeled. The conservation equations of mass and momentum are written in the porous-media formulation by means of local volume averaging. The concept of cell surface permeability has been fully employed in cold-flow (isothermal) modeling of a swirl combustor with such louvres. This modeling technique is expected to significantly enhance the capability of existing combustor codes in predicting realistic performance characteristics. DOE

N86-16309# Midwest Research Inst., Golden, Colo.
AMORPHOUS SILICON MEASUREMENTS TASK FORCE Final Report
R. L. Hulstrom Aug. 1985 60 p
(Contract DE-AC02-83CH-10093)
(DE85-012174; SERI/SP-215-2784) Avail: NTIS HC A04/MF A01

This report documents the results of the Amorphous Silicon Measurements Task Force, a part of the Amorphous Silicon Research Project of the Solar Energy Research Institute. The task force was formed to make specific recommendations to the a-Si community that would lead to improving indoor and outdoor performance measurements and reporting of results. Approximately 30 recommendations were made, and they are contained in this report. DOE

N86-16310# Lawrence Livermore National Lab., Calif.
IN-BEAM SPECTROSCOPY USING THE (t,p) REACTION: RECENT RESULTS NEAR A = 100
E. A. Henry, R. J. Estep, R. A. Meyer, J. Kantele, D. J. Decman, L. G. Mann, R. K. Sheline, W. Stoeffl, and L. E. Ussery Sep. 1985 8 p Presented at the 190th American Chemical Society National Meeting, Chicago, Ill., 8 Sep. 1985 Prepared in cooperation with Florida State Univ., Tallahassee.; Jyvaskyla Univ. (Finland); Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-48)
(DE85-017471; UCRL-93302; CONF-850942-20) Avail: NTIS HC A02/MF A01

Charged particle spectroscopy using the (t,p) reaction has been employed for more than two decades to study the low energy structure of nuclei. This reaction has contributed significantly to the elucidation of single-particle and collective phenomena for neutron rich nuclei in virtually every mass region. We have begun to use the (t,p) reaction in conjunction with in-beam (GAMMA)-ray and conversion-electron spectroscopy to bring additional understanding to low-energy nuclear structure. In this report we briefly discuss the experimental considerations in using this reaction for in-beam spectroscopy, and present some results for nuclei with mass near 100. DOE

N86-16311# Department of Energy, Washington, D. C.
LIQUID CHROMATOGRAPHY/FOURIER TRANSFORM IR SPECTROMETRY INTERFACE FLOW CELL Patent Application
C. C. Johnson and L. T. Taylor, inventors (to DOE) Filed Jan. 1985 34 p
(Contract DE-FG22-81PC-40799)
(DE85-017749; US-Patent-Appl-SN-689104) Avail: NTIS HC A03/MF A01

A zero dead volume (ZDV) microbore high performance liquid chromatography (MU HPLC)/Fourier transform infrared (FTIR) interface flow cell includes an IR transparent crystal having a small diameter bore therein through which a sample liquid is passed. The interface flow cell further includes a metal holder in combination with a pair of inner, compressible seals for directly coupling the thus configured spectrometric flow cell to the outlet of a MU HPLC column end fitting to minimize the transfer volume of the effluents exiting the MU HPLC column which exhibit excellent flow characteristics due to the essentially unencumbered, open-flow design. The IR beam passes transverse to the sample flow through the circular

bore within the IR transparent crystal, which is preferably comprised of potassium bromide (KBr) or calcium fluoride (CaF2), so as to minimize interference patterns and vignetting encountered in conventional parallel-plate IR cells. The long IR beam pathlength and lensing effect of the circular cross-section of the sample volume in combination with the refractive index differences between the solvent and the transparent crystal serve to focus the IR beam in enhancing sample detection sensitivity by an order of magnitude. DOE

N86-16312# Department of Energy, Washington, D. C.
APPARATUS AND METHOD FOR THE PREPARATION OF DIOXYGEN DIFLUORIDE Patent Application
W. H. Beattie, inventor (to DOE) Filed 30 Jan. 1985 12 p
(Contract W-7405-eng-36)
(DE85-017787; US-Patent-Appl-SN-696548) Avail: NTIS HC A02/MF A01

Dioxygen difluoride, O2F2, is prepared in high yield by microwave discharge of a flowing gas mixture of F2 with or without a carrier gas such as argon or helium with the subsequent reaction of the discharge products with molecular gaseous oxygen downstream from and outside of the region of discharge. The O2F2 product is collected by cryogenic trapping, and is free of oxygen difluoride impurity and ozone since the oxygen molecules are not dissociated before they react with the microwave discharge products. DOE

N86-16313# Department of Energy, Washington, D. C.
GLASS ELECTROLYTE COMPOSITION Patent Application
G. H. Kucera (Argonne National Lab., Ill.) and M. F. Roche, inventors (to DOE) (Argonne National Lab., Ill.) Filed Jan. 1985 12 p
(Contract W-31-109-eng-38)
(DE85-017750; US-Patent-Appl-SN-689735) Avail: NTIS HC A02/MF A01

An ionically conductive glass is disclosed for use as electrolyte in a high temperature electrochemical cell, particularly a cell with sodium anode and sulfur cathode. The glass includes the constituents Na2O, ZrO2, Al2O3 and SiO2 in selected proportions to be a single phase solid solution substantially free of crystalline regions and undissolved constituents. Other advantageous properties are an ionic conductivity in excess of 2 x 10 (-3) (ohm-cm) (-1) at 300 C and a glass transition temperature in excess of 500(0)C. DOE

N86-16314# Brookhaven National Lab., Upton, N. Y.
RECENT DEVELOPMENTS IN THERMOLUMINESCENCE KINETICS: APPLICATIONS TO OTHER THERMALLY STIMULATED PROCESSES
P. W. Levy Aug. 1985 9 p refs Presented at the 14th North American Thermal Analysis Society Conference (NATAS), San Francisco, Calif., 1 Sep. 1985
(Contract DE-AC02-76CH-00016)
(DE85-018482; BNL-36909; CONF-8509144-2) Avail: NTIS HC A02/MF A01

Recent thermoluminescence (TL) studies indicate that many kinetic properties are not in accord with the well known 1st and 2nd order TL kinetic equations. For example, the usual equations do not describe: (1) the shape of certain single glow peaks; (2) the shape of glow peaks in many glow curves containing more than one glow peak; and (3) the dependence of the peak temperature, the FWHM, the shape, and other properties on the pre-measurement dose. However, the properties of some single glow peaks are precisely described, or closely approximated by, the more general basic equation from which the usual 1st and 2nd order equations are obtained as special cases. Furthermore, glow curves containing more than one glow peak are described by a system of equations that includes interactions between different types of traps and is a straightforward extension of the general one peak equation. This system - called Interactive Kinetics - accounts for most properties, and explains many anomalies, associated with glow curves containing more than one glow peak. It is particularly convenient for computerized analysis procedures. Lastly, it is suggested that other thermally stimulated processes depend on analogous interactions and are describable by similar sets of kinetic equations that are convenient for computer analysis. DOE

N86-16315# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
THE TWO-FLUID MODEL OF TURBULENT COMBUSTION APPLIED TO AN IDEALISED ONE-DIMENSIONAL, UNSTEADY, CONFINED, PRE-MIXED FLAME
J. Z. Y. Wu Aug. 1984 59 p refs
(PDR/CFDU/IC/21) Avail: NTIS HC A04/MF A01

The two-fluid model of turbulent combustion was applied to a one-dimensional, unsteady, confined, premixed flame with idealized initial and boundary conditions. The results show that steady oscillations may occur after the steady-state flame is disturbed. A systematic, parametric study is performed to establish instability regions. The results indicate a possible mechanism of oscillatory burning in, for example, afterburner systems for aircraft jet engines. Author (ESA)

N86-16316# Research Triangle Inst., Research Triangle Park, N.C.
EVALUATION OF METHODS FOR ANALYSIS OF HUMAN FAT, SKIN, NAILS, HAIR, BLOOD AND URINE
L. Sheldon, M. Umana, J. Bursey, W. Gutknecht, and R. Handy Aug. 1985 366 p
(Contract EPA-68-03-3149)
(PB85-242790; EPA-600/8-85-018) Avail: NTIS HC A16/MF A01 CSCL 07D

The research program surveyed and evaluated the methods and procedures to identify and quantitate chemical constituents in human tissues and fluids including fat, skin, nails, hair, blood, and urine. These methods were evaluated to determine their ease and rapidity, as well as cost, accuracy, and precision. During this evaluation, the feasibility of correlating a preferred method with a specific tissue/fluid and with easily identifiable chemical characteristics, such as octanol-water partition coefficient, water solubility, vapor pressure, etc., was determined. The search strategy, as well as the literature evaluation focussed on analytical methods. GRA

N86-16317# National Bureau of Standards, Boulder, Colo. Chemical Engineering Science Div.
EXPERIMENTAL THERMAL CONDUCTIVITY VALUES FOR MIXTURES OF METHANE AND ETHANE Final Report
H. M. Roder and D. G. Friend Mar. 1985 43 p
(PB85-226066; NBSIR-85-3024) Avail: NTIS HC A03/MF A01 CSCL 07D

The experimental measurements of thermal conductivity as obtained in a transient hot wire apparatus for mixtures of methane and ethane are recorded. The measurements were made at temperatures between 140 and 330 K with pressures between 0.1 and 70 MPa. The density range is 0 to 24 mol/L, the mole fractions of methane are 0.69, 0.50, 0.35, and the total number of points recorded is 2476. Author

N86-16318# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
HEAT CAPACITY MEASUREMENTS ON PLUTONIUM PHOSPHIDE
R. O. A. Hall, A. J. Jeffery, J. A. Lee, M. J. Mortimer, and G. H. Lander (Argonne National Lab., Ill.) Apr. 1985 24 p
(AERE-R-11075) Avail: NTIS HC A02/MF A01

The heat capacity of plutonium phosphide PUP-202 has been measured using a transient method from 8.3K to 18K and using an adiabatic calorimeter from 11.4K to 303K. In the region of overlap the results for the two techniques agreed well. The heat capacity was of the normal sigmoid form with a large magnetic peak superimposed at (125.5 + or - 0.5)K, the Curie temperature. There is also a small anomaly of unknown origin at 17.5K. The parameters from the heat capacity analysis are given. DOE

N86-16319# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
THE EFFECTS OF AQUEOUS SILICA ON THE HYDROTHERMAL DISSOLUTION OF PEROVSKITE (CaTiO3)
S. Myhra, H. E. Bishop, and J. C. Riviere Apr. 1985 30 p
(AERE-R-11729) Avail: NTIS HC A03/MF A01

Perovskite (CaTiO3) has been exposed to hydrothermal chemical attack in H2O saturated with aqueous silica. Dependences on temperature (150 to 250 C) and on duration of attack (1 to 35 days) have been investigated. It was found that a modified surface layer was formed. The thickness of this layer ranged from a few monolayers to several hundred nanometers for the least and the most severe hydrothermal conditions, respectively. The compositions of the modified layer, as deduced by surface analytical techniques, suggest that: (1) alkaline earth species are leached initially, (2) there is a TiO2 rich reaction front at the interface between the modified layer and the perovskite bulk, and (3) sphene (CaTiSiO5) and SiO2 (gel) occur as significant precipitate phases in the modified layer. DOE

N86-16446# University of Electro-Communications, Tokyo (Japan).
CARBON-14 NMR SPECTRUM (68 MHz) OF 2,6-DINITROPHENOL IN CDCl3 AND THE TEMPERATURE VARIATION OF THE CHEMICAL SHIFTS IN REFERENCE TO INTRAMOLECUAR HYDROGEN BOND
Ariyuki Aihara and Kazuhiro Matsushita *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 61-65 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-16320# Electricity Council, London (England). Overseas Relations Branch.
ELECTRODEPOSITION OF LESS FREQUENTLY USED COATING METALS
A. Knoedler Aug. 1985 10 p refs Transl. into ENGLISH from Jahrbuch der Oberflaechentechnik (West Germany), v. 40, 1984 p 92-96
(BLL-OA-Trans-3248-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

The electrodeposition of some metal coatings is described. The metals discussed are aluminum, iron, cobalt, manganese, silicon, and indium. Very briefly mentioned are selenium, antimony, lead, titanium, rhenium, tungsten and uranium. An extensive bibliography is included. E.R.

N86-16321 Cincinnati Univ., Ohio.
ANISOTROPIC CONSTITUTIVE MODEL FOR NICKEL BASE SINGLE CRYSTAL ALLOYS: DEVELOPMENT AND FINITE ELEMENT IMPLEMENTATION Ph.D. Thesis
L. Thomas Dame 1985 136 p
Avail: Univ. Microfilms Order No. DA8518123

A tool was developed for the mechanical analysis of nickel base single crystal superalloys, specifically Rene N4, used in gas turbine engine components. This is achieved by developing a rate dependent anisotropic constitutive model and implementing it in a nonlinear three dimensional finite element code. The constitutive model is developed from metallurgical concepts utilizing a crystallographic approach. A non Schmid's law formulation is used to model the tension/compression asymmetry and orientation dependence in octahedral slip. Schmid's law is a good approximation to the inelastic response of the material in cube slip. The finite element implementation utilizes an initial strain method and twenty noded isoparametric solid elements. The ability to model piecewise linear load histories is included in the finite element code. Computed results from the finite element code are compared with experimental data for tensile, creep and cyclic tests at 760 C. The strain rate sensitivity and stress relaxation capabilities of the model are evaluated. Dissert. Abstr.

N86-16322 Drexel Univ., Philadelphia, Pa.
PROCESSING, MICROSTRUCTURE AND PROPERTY RELATIONSHIPS IN A POWDER METALLURGY HIGH SPEED STEEL Ph.D. Thesis
Au Syed Fareed 1985 229 p
Avail: Univ. Microfilms Order No. DA8516206

REX 25tm high speed steel, processed from rapidly solidified gas atomized powder, was studied in detail with respect to microstructure, strength, toughness, grindability, wear resistance and hardness at elevated temperatures. Powders were nitrogen gas atomized, screened to specific size fractions and consolidated to full density by hot isostatic pressing. The HIPed material was either heat treated or hot worked by forging prior to heat treatment. Two HIPing temperatures, two austenitizing temperatures and three tempering temperatures were evaluated. X-ray diffraction, optical and scanning electron microscopy were utilized to characterize the microstructure in the atomized and consolidated conditions. Atomized powders exhibit segregated structures, with MC and M2C carbides present in the form of an interconnected network. The proportion of MC carbides increases and the scale of microstructure is refined, with decreasing powder particle size. Traces of M6C carbides are observed in the coarse size fractions. Dissert. Abstr.

N86-16323 Connecticut Univ., Storrs.
ALUMINUM ION IMPLANTATION INDUCED PHASE CHANGES IN NICKEL Ph.D. Thesis
Munir Ahmed 1985 143 p
Avail: Univ. Microfilms Order No. DA8516171

Aluminum ions were implanted into nickel substrates to fluences ranging from 1 x 10 to the 19th power ions/sq m to 4 x 10 to the 22nd power ions/sq m. The substrate temperatures during implantation were fixed at selected temperatures between 25 C and 600 C. The composition versus depth profiles were determined as were the microstructures in the implanted layers. The phases observed during the room temperature implantation included the nickel solid solution with extended aluminum solubility, an HCP phase, beta prime-NiAl and an amorphous phase. The stability of the as-implanted microstructures obtained from room temperature implantation was investigated by aging the specimens at temperatures between 400 C to 800 C and for time intervals ranging from a few minutes to several hours. Both gamma prime and beta prime phases were observed in specimens implanted at elevated temperatures. These phases were fully ordered in the as-implanted state and the beta prime exhibited a texture similar to that which it exhibits in room temperature implanted specimens. Dislocation loops and voids were observed at lower fluences. The microstructures present below the implanted layers were investigated and their role in the subsequent phase transformations is discussed. Dissert. Abstr.

N86-16324 Oregon State Univ., Corvallis.
BIAXIAL FATIGUE BEHAVIOR OF COMMERCIALLY PURE TITANIUM Ti-50A (GRADE 2) AND LOW-ALLOY TITANIUM Ti-CODE 12 (GRADE 12) HEAT EXCHANGER MATERIALS Ph.D. Thesis
Benjamin Catulong Tobias 1985 178 p
Avail: Univ. Microfilms Order No. DA8518618

An experimental investigation was conducted to evaluate the biaxial fatigue behavior of commercially pure titanium Ti-50A and low-alloy titanium Ti-Code 12 heat exchanger materials. The biaxial state of stress was composed of an axial stress and a superimposed torsional stress, applied in a thin wall tubular specimen machined from titanium tubing. Torsional stress was applied independently using a torsion machine and a torque fixer assembly. The biaxial fatigue test under load control condition was done under fully reversed cycles equivalent to a biaxiality ratio of -1. The results are presented in terms of the various measured or calculated quantities versus number of cycles to fracture. Biaxial

fatigue curves were drawn through the experimental points corresponding to Weibull's mean life criterion. The four data points exhibit scatter that appears to be related to the applied stress amplitude. It was also found that a correlation exists between the magnitude of applied cyclic biaxial stress and fatigue life to failure. In addition, the results have been discussed taking existing failure criteria into account. Dissert. Abstr.

N86-16325 British Library Lending Div., Boston Spa (England).
THE EFFECT OF MELT COOLING SPEED ON THE STRUCTURE OF X-RAY EMISSION SPECTRA FOR NI58Nb42 ALLOY
V. V. Savin, Z. A. Samoilenk, and Yu. A. Skakov [1985] 4 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii Chernaya Metallurgiya (USSR), no. 3, 1985 p 154-155 (BLL-M-36452-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect of melt cooling speed on the structure of X-ray emission spectra for Ni58Nb42 alloy was examined. The X-ray spectra for Ni58Nb42 alloy were analyzed under different processing methods. G.L.C.

N86-16326 British Library Lending Div., Boston Spa (England).
HIGH RESIDUAL MAGNETISATION OF Sm2Co17 SPRAY-COATED FILMS
I. P. Salo, Yu. D. Yagolkin, and V. V. Kotunov [1985] 4 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii Chernaya Metallurgiya (USSR), no. 3, 1985 p 155-156 (BLL-M-36453-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

As the result of experiments it can be concluded that residual magnetization in spray coated films is not the result of their crystallographic texture. Author

N86-16327 British Library Lending Div., Boston Spa (England).
DETERMINATION OF PHYSICAL YIELD STRENGTHS OF STEELS
L. N. Sokolov, V. N. Efimov, V. N. Demin, and V. V. Savitskii [1985] 6 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii Chernaya Metallurgiya (USSR), no. 3, 1985 p 47-49 (BLL-M-36426-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The numerical values of physical yield strengths can be determined from the hardening curves obtained with no indication of yield point for the forging and rolling temperature ranges, provided the principles of constancy of the relative hardening of hot-deformed austenite are used. The physical yield strengths found by such a method follow N.S. Kurnakov's rule. Author

N86-16328 British Library Lending Div., Boston Spa (England).
KINETICS OF THE EVAPORATION OF LIQUID NICKEL
Yu. V. Balkovoi, R. A. Aleev, V. K. Bakanov, V. A. Grigoryan, D. V. Zimin, and E. V. Butskii [1985] 8 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii Chernaya Metallurgiya (USSR), no. 3, 1985 p 43-46 (BLL-M-36425-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Because the chemical composition of the steel is not routinely monitored in vacuum metallurgy, the sources of losses, particularly evaporation, must be taken into account. There is a lack of data on the kinetics of evaporation in nickel-based alloys. The results of research on the kinetics of evaporation of solid and liquid nickel at steelmaking temperatures are considered. Equations are presented for the relationship between the rate of evaporation of nickel and residual pressure, temperature and surface-active substances. A method for calculating the variation in the surface tension of an alloy is suggested based on data relating to the evaporation rate in a kinetic regime. Author

N86-16329 British Library Lending Div., Boston Spa (England).
EXPERIMENTAL INVESTIGATION OF AMOUNT OF SHEAR DEFORMATION OVER HEIGHT OF ROLLED WORKPIECE
V. K. Vorontsov, R. E. Gafarov, and V. V. Lashin [1985] 6 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebenykh Zavedenii Chernaya Metallurgiya (USSR), no. 3, 1985 p 59-62 (BLL-M-36428-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

In view of the importance of shear deformation as a quantative characteristic of the strain state and ductility resource of the metal in processes of working by pressure, a series of experiments was conducted with lead-antimony testpieces employing the moire band method and tabulated the results for the changes in the geometric dimensions and irregular distribution of the shear deformation over the height of the testpieces. As distinct from previous research, it was found that the highest shear deformations occur in the intermediate layers of the workpiece rather than at the points of contact. Author

N86-16330 British Library Lending Div., Boston Spa (England).
ASSESSMENT OF FORMS OF EXISTENCE OF BORATE GROUPS ACCORDING TO ENERGIES OF PARTICLE INTERACTION
S. P. Kurlov, B. M. Lepinskikh, and O. I. Bukhtoyarov [1985] 8 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii Chernaya Metallurgiya (USSR), no. 3, 1985 p 4-8 (BLL-M-36422-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The Mullicen formula was used to calculate the energies of atomization of boron-oxygen complexes of different degrees of complexity. An examination was made of the equilibrium of boron-oxygen anions with ternary and quaternary coordinations. Author

N86-16331 British Library Lending Div., Boston Spa (England).
HIGH TEMPERATURE VAPOUR PRESSURES OF STAINLESS STEEL AND SOME PURE METALS FROM LASER-VAPORATION EXPERIMENTS
M. Bober and J. Singer Sep. 1985 13 p refs Transl. into ENGLISH from KfK Nachrichten (West Germany), 17th year, Jan. 1985 p 32-36
(BLL-WH-637-(9091-9F)) Avail: British Library Lending Div., Boston Spa, Engl.

For determination of the high temperature vapor pressures of nuclear fuels, several non-stationary methods of measurement had already been tested. A few methods are based on short-term surface evaporation of the material by laser heating under vacuum or under a diluted buffer gas atmosphere. The evaluation of these measurements does however require complex gas-dynamic corrections, which lead to relatively wide uncertainties in the vapor pressure data obtained. Accordingly a new method was developed, based on a quasi-stationary laser evaporation under a defined inert gas counter-pressure. The evaporation temperature is determined by analog with the classical boiling point method, this corresponding under the appropriate ambient pressure to the boiling point of the sample material. This method provides direct experimental vapour pressure values, the accuracy of which satisfies without additional corrections the requirements of reactor safety analysis. G.L.C.

N86-16332# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
ABNORMAL GRAIN GROWTH IN NIMONIC PE16 ALLOY AND ITS EFFECTS ON THE TENSILE PROPERTIES
J. Cook and A. C. Roberts Mar. 1985 10 p refs Presented at the BNES Conference on Nuclear Fuel Performance, 25-29 March 1985
(AERE-R-11640; AGR/FPWG/P(85)576; Gen/TBSC/P(85)6170/A/1; PFR-Clad-Panel-Note-830) Avail: Issuing Activity

The susceptibility of Nimonic PE16 alloy to secondary recrystallization in the temperature range 1000 C to 1080 C was investigated. At annealing temperatures of 1060 C and above it is considered to be due to the dissolution or coarsening of Ti(CN) precipitates and enhanced by low levels (less than 5%) of cold work. Below 1060 C it is considered to be due entirely to low levels of cold work. Primary recrystallization occurred when the

level of cold work was raised to between 5 and 10%. Tensile data show that in general the total elongation increased and the 0.1 proof stress and U.T.S. decreased with annealing temperature. Author

N86-16333*# McDonnell-Douglas Research Labs., St. Louis, Mo.
STUDY ON EFFECTS OF POWDER AND FLAKE CHEMISTRY AND MORPHOLOGY ON THE PROPERTIES OF Al-Cu-Mg-X-X-X POWDER METALLURGY ADVANCED ALUMINUM ALLOYS Final Report
P. J. Meschter, R. J. Lederich, J. E. ONeal, and P. S. Pao Nov. 1985 108 p refs
(Contract NAS1-17107)
(NASA-CR-177946; NAS 1.26:177946; MDC-01227) Avail: NTIS HC A06/MF A01 CSCL 11F

The effects of alloy chemistry and particulate morphology on consolidation behavior and consolidated product properties in rapid solidification processed, powder-metallurgical Al-3Li-1.5Cu-1Mg-0.5Co-0.2Zr and Al-4.4Cu-1.5Mg-Fe-Ni-0.2Zr extrusions and forgings were studied. Microstructures and mechanical properties of both alloys are largely unaffected by particulate production method (vacuum atomization, ultrasonic atomization, or twin-roller quenching) and by particulate solidification rates between 1000 and 100,000 K/s. Consolidation processing by canning, cold compaction, degassing, and hot extrusion is sufficient to yield mechanical properties in the non-Li-containing alloy extrusions which are similar to those of 7075-Al, but ductilities and fracture toughnesses are inferior owing to poor interparticle bonding caused by lack of a vacuum-hot-pressing step during consolidation. Mechanical properties of extrusions are superior to those of forgings owing to the stronger textures produced by the more severe hot working during extrusion. The effects on mechanical properties of dispersoid size and volume fraction, substructural refinement, solid solution strengthening by Mg, and precipitate size and distribution are elucidated for both alloy types. Author

N86-16334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL AGING EFFECTS IN REFRACTORY METAL ALLOYS
Joseph R. Stephens 1986 28 p refs Presented at the 3rd Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 13-15 Jan. 1986; sponsored by the American Nuclear Society
(NASA-TM-87210; E-2869; NAS 1.15:87210) Avail: NTIS HC A03/MF A01 CSCL 11F

The alloys of niobium and tantalum are attractive from a strength and compatibility viewpoint for high operating temperatures required in materials for fuel cladding, liquid metal transfer, and heat pipe applications in space power systems that will supply from 100 kWe to multi-megawatts for advanced space systems. To meet the system requirements, operating temperatures ranging from 1100 to 1600 K have been proposed. Expected lives of these space power systems are from 7 to 10 yr. A program is conducted at NASA Lewis to determine the effects of long-term, high-temperature exposure on the microstructural stability of several commercial tantalum and niobium alloys. Variables studied in the investigation include alloy composition, pre-age annealing temperature, aging time, temperature, and environment (lithium or vacuum), welding, and hydrogen doping. Alloys are investigated by means of cryogenic bend tests and tensile tests. Results show that the combination of tungsten and hafnium or zirconium found in commercial alloys such as T-111 and Cb-752 can lead to aging embrittlement and increased susceptibility to hydrogen embrittlement of ternary and more complex alloys. Modification of alloy composition helps to eliminate the embrittlement problem. Author

N86-16335# Royal Armament Research and Development Establishment, Fort Halstead (England).
THE EFFECT OF ALLOY STEEL DESIGN AND HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF 3 1/4 NiCrMoV STEEL
T. D. Andrews, R. Hawkins, and S. R. Keown Apr. 1985 20 p
(AD-A159486; RARDE-1/85; DRIC-BR-95725) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report describes work carried out to optimize the composition of 3 1/4 NiCrMoV steels through a stoichiometric balance of the carbon content with the carbide-forming elements Cr, Mo and V. Reduction of the carbon content to the stoichiometric level gives a steel having a very high Charpy upper shelf energy, but the grain refining effect of the carbides is lost and the impact transition temperature increases. An optimized steel containing a slight excess of carbon has been developed that gives a better strength/toughness combination than the commercial steel.
Author (GRA)

N86-16336 Imperial Coll. of Science and Technology, London (England). Dept. of Metallurgy and Materials Science.
HOT CORROSION AND PROTECTION MECHANISMS OF MARINE GAS TURBINE MATERIALS, VOLUMES 1 AND 2
M. G. Hocking and V. Vasantasree 1985 132 p refs
(Contract ERiA/9/4/2037/0150-AMTE)
(BR96018-Vol-1/2) Avail: NTIS HC A07/MF A01

Experimental MCr AlX alloys were examined to establish an alloy composition range with improved resistance to low temperature (700 C) accelerated sulfur-induced corrosion, while maintaining adequate performance at high temperature (900 C). The detrimental effects of Ni at all levels and at especially high concentrations in causing accelerated attack at 700 C are confirmed. A variable tendency to thermal spalling of scales alloy to alloy is observed and good adherence is exhibited by an alloy containing Ti and Si; Ta is particularly effective in reducing the sulfide fraction in the scale and alloy matrix, while enhancing chromia formation. At 900 C, corrosion damage is much less with all of the materials than at 700 C. Results suggest that alloys for service in oxygen + sulfur containing environments at high and low temperatures can be developed. Author (ESA)

N86-16337# Naval Postgraduate School, Monterey, Calif.
MECHANICAL CHARACTERISTICS OF A SUPERPLASTIC ALUMINUM-10.2%Mg-0.1%Zr ALLOY M.S. Thesis
T. S. Hartmann Jun. 1985 98 p
(AD-A158959) Avail: NTIS HC A05/MF A01 CSCL 11/6

The elevated temperature mechanical characteristics of an aluminum-magnesium-zirconium alloy were studied. Thermomechanical processing consisted of solution treating and hot working at 440 C and then warm rolling at 300 C to 94% reduction. Subsequent treatments included annealing at 200 C for one hour, and recrystallizing for one minute at 440 C. Tensile testing of warm rolled, annealed, and recrystallized material was conducted at various strain rates and temperatures. The data was analyzed to determine strain-rate sensitivity coefficients and activation energies, in turn to be correlated with microstructural data concurrently obtained on this superplastic alloy. This material exhibits particularly good ambient properties in addition to the superplasticity. GRA

N86-16338# Naval Research Lab., Washington, D. C.
THE CORROSION BEHAVIOR OF A GRAPHITE FIBER/MAGNESIUM METAL MATRIX COMPOSITE IN AQUEOUS CHLORIDE SOLUTION Final Report, Dec. 1983 - Dec. 1984
P. P. Trzaskoma 19 Sep. 1985 19 p
(AD-A159121; NRL-MR-5640) Avail: NTIS HC A02/MF A01 CSCL 11/4

The corrosion behavior of a graphite fiber/magnesium composite has been studied in dilute chloride solutions by immersion, SEM, and electrochemical techniques. The composite consists of graphite fibers coated with magnesium alloy AZ91C pressed between thin foils of alloy AZ31B. Within five days immersion in 0.0001 N NaCl, severe localized corrosion develops at the edges of the material where there are exposed graphite fibers. The reaction is accompanied by visible hydrogen evolution over the entire surface and attack is through the foil covering into the underlying matrix material. Electrochemical measurements in a chloride solution of borated boric acid (pH 8.4, 1000 ppm C(-) reveal significant galvanic currents between the magnesium foil

and graphite fibers. These currents increase as the surface area ratio of graphite to magnesium increases. From this work it is concluded that galvanic interaction plays an important role in the aqueous corrosion of graphite/magnesium composites. GRA

N86-16339# Department of Energy, Washington, D. C.
PREPARING REFLECTIVE SUBSTRATE SURFACES FOR LASER TREATMENT Patent Application
F. F. Flick, inventor (to DOE) (Los Alamos National Lab., N. Mex.) Filed 21 Nov. 1985 7 p
(Contract W-7405-eng-36)
(DE85-017774; US-Patent-Appl-SN-673970) Avail: NTIS HC A02/MF A01

A coating of either copper oxide or felt tip pen ink is used on reflective copper or gold substrates to enhance laser beam coupling when the substrates are cut or welded with a laser. DOE

N86-16340# California Univ., Berkeley. Lawrence Berkeley Lab.
THEORETICAL ANALYSIS OF THE AGING RESPONSE OF Al-Li ALLOYS STRENGTHENED BY Al3Li PRECIPITATES
J. Glazer, T. S. Edgecumbe, and J. W. Morris, Jr. Jun. 1985 19 p Presented at the 3rd International Aluminum-Lithium Conference, Oxfordshire, England, 9 Jul. 1985
(Contract DE-AC03-76SF-00098)
(DE85-016570; LBL-19235; CONF-850777-1) Avail: NTIS HC A02/MF A01

The possibility of increasing the strength of aluminum-lithium alloys hardened principally by the delta' precipitates was investigated. The elastic theory of phase transformations was used to determine that the delta' precipitate is not expected to deviate from spherical morphology even at very large sizes. The theory of the critical resolved shear stress for dislocation glide through a random array of obstacles was used to predict a moderate strengthening increment if the precipitate size distribution could be made more uniform. Experimental and theoretical hardening curves for an experimentally determined precipitate size distribution were also compared. DOE

N86-16341# Argonne National Lab., Ill. Materials Science and Technology Div.
FRACTURE BEHAVIOR AND MICROSTRUCTURAL CHARACTERISTICS OF IRRADIATED ZIRCALOY CLADDING
H. M. Chung, F. L. Yaggee, and T. F. Kassner Jun. 1985 56 p Presented at the 7th International Conference on Zirconium in the Nuclear Industry, Strasbourg, France, 24-27 Jun. 1985 Sponsored in part by Nuclear Regulatory Commission, Washington, D.C.
(TI85-014994; CONF-850601-1) Avail: NTIS HC A04/MF A01

Zircaloy cladding tube specimens from commercial power reactor fuel assemblies have been deformed to fracture at 325 C by either the internal gas pressurization or the expanding mandrel technique in a helium or argon environment containing no fission product species. The fracture surfaces of 11 irradiated specimens fractured by internal gas pressurization were examined by scanning electron microscopy, and 7 specimens were found to contain various degrees of the pseudocleavage feature that is characteristic of pellet-cladding interaction failures. The specimens exhibited X-marks on the outer surface and brittle incipient cracks distributed on the inner surface, which are also characteristic of pellet-cladding interaction failures. Transmission/high voltage electron microscope examinations of the thin-foil specimens obtained from regions adjacent to the failure sites showed that the ductile failure specimens were characterized by a high density of dislocations which showed normal a + - type Burgers vectors. In contrast, the brittle-type specimens were characterized by comparatively few dislocations which formed substructures. These occurrences and their causes are discussed. Author

N86-16342# Oak Ridge National Lab., Tenn.
TEM-APFIM INVESTIGATION OF BORON-DOPED NI3Al
J. A. Horton and M. K. Miller 1985 7 p Presented at the 32nd International Field Emission Symposium, Wheeling, W. Va., 15 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017154; CONF-850788-1) Avail: NTIS HC A02/MF A01

Boron additions to normally brittle Ni3Al result in room temperature ductilities over 50%. Little is presently known about the role of boron in strengthening the otherwise brittle grain boundaries. A TEM structural characterization of cast material shows a featureless microstructure while rapidly solidified material has substantial aluminum enrichments coupled with a bimodal APB distribution. Preliminary atom probe investigations of cast material found the boron in solution, with no evidence of clustering in the grain interiors. A small enrichment of boron was found at twin boundaries. DOE

N86-16343# Oak Ridge National Lab., Tenn.
ANNEALING STUDIES OF ALPHA-Al2O3 IMPLANTED WITH BROMINE
G. C. Farlow, C. J. McHargue, C. W. White, and B. R. Appleton Jul. 1985 16 p Presented at the International Conference on Radiation Effects in Insulators, Guildford, England, 15 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-015415; CONF-850781-2) Avail: NTIS HC A02/MF A01

Aluminum oxide was implanted with bromine and subsequently annealed at temperatures between 800 and 1500 C in a reducing atmosphere. Changes in the lattice damage and the impurity distribution were monitored at Rutherford backscattering and channeling (RBS-C) techniques. Changes in the topography were monitored by optical and secondary electron microscopy. The implantation resulted in the formation of an amorphous surface layer. Upon annealing, the bromine segregated to form bubbles which blistered releasing 90% of the bromine from the Al2O3 matrix. DOE

N86-16344# Syracuse Univ., N. Y. Dept. of Physics.
UHV-AES INVESTIGATION OF SULFUR SURFACE SEGREGATION IN PRECIOUS METAL WEAR TRACKS
J. N. Lloyd, R. W. Vook, and L. E. Pope 1985 16 p Presented at IEEE Holm Conference on Electrical Currents, Chicago, Ill., 30 Sep. 1985 Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE85-009103; SAND-84-2477C; CONF-850959-1) Avail: NTIS HC A02/MF A01

Cyclic sliding experiments of a palladium base (ASTM B540) alloy pin on a gold base (ASTM B541) alloy plate have been completed in an ultrahigh vacuum system that was backfilled to one atmosphere with spectroscopic grade helium. The elemental concentrations in the wear tracks were measured in situ by Auger electron spectroscopy before and after several thousand cycles were performed. The concentration of sulfur in the wear tracks showed an appreciable increase (a factor of 2.5 to 6.4) relative to off track regions. The sulfur enhancement was dependent on the number of sliding cycles. Residual gas analysis of the vacuum system atmosphere before introduction of the helium and analysis of the spectroscopic grade helium detected no sulfur containing gases; it is estimated that the partial pressure of sulfur containing gases was less than approx. 1 x 10 to the minus 7th power torr for all experiments, less than 0.2 ppB in the helium atmosphere. It is concluded that the sulfur originates in the bulk of the alloys. DOE

N86-16345# Lawrence Livermore National Lab., Calif.
HIGH-PRESSURE ION-THERMAL PROPERTIES OF METALS FROM AB INITIO INTERATOMIC POTENTIALS
J. A. Moriarty Jun. 1985 10 p refs Presented at the American Physics Topical Conference on Shock Waves in Condensed Matter, Spokane, Wash., 22 Jul. 1985
(Contract W-7405-eng-48)
(DE85-016079; UCRL-92899; CONF-850736-55) Avail: NTIS HC A02/MF A01

It has recently become possible for the first time to calculate ab initio two-ion and three-ion interatomic potentials in d-electron transition metals. The nature of these potentials for the third series metals is discussed. In the case of copper, where three-ion contributions may be neglected, application is made to the

ion-thermal component of the equation of state and to the calculation of melting on the shock Hugoniot. DOE

N86-16346# Illinois Inst. of Tech., Chicago.
DENDRITIC ZINC DEPOSITION FROM FLOWING ACIDIC SOLUTIONS Final Report
J. R. Selman and W. C. Hsie Mar. 1985 92 p
(Contract DE-AC03-76SF-00098)
(DE85-016484; LBL-19758) Avail: NTIS HC A05/MF A01

This report covers two topics of research related to the operation and design of zinc/halogen batteries: (1) mass transfer and speciation in concentrated zinc halide electrolytes; (2) growth of dendritic zinc deposits under conditions of well-defined convection. DOE

N86-16347# Lawrence Livermore National Lab., Calif.
DEPOSITION OF SELENIUM COATINGS ON BERYLLIUM FOILS, REVISION 1
E. D. Erikson, P. L. Tassano, R. H. Reiss, and G. E. Griggs 1984 14 p Presented at the 12th World Conference of the International Nuclear Target Development Society, Antwerp, Belgium, 25 Sep. 1984
(Contract W-7405-eng-48)
(DE85-016070; UCRL-91561-Rev-1; CONF-8409150-5-Rev-1) Avail: NTIS HC A02/MF A01

A technique for preparing selenium films on 50.8 micrometers thick beryllium foils is described. The selenium was deposited in vacuum from a resistance heated evaporation source. A water-cooled enclosure was used to minimize contamination of the vacuum system and to reduce the exposure of personnel to toxic and obnoxious materials. Profilometry measurements of the coatings indicated selenium thicknesses of 5.5, 12.9, 37.5, 49.8 and 74.5 micrometers. The control of deposition rate and of coating thickness was facilitated using a commercially available closed-loop programmable deposition controller. The X-ray transmission of the coated substrates was measured using a tritiated zirconium source. The transmissivities of the film/substrate combination are presented for the range of energies from 4 to 20 keV. DOE

N86-16348# Los Alamos National Lab., N. Mex.
EVALUATION OF ANELASTIC EVIDENCE FOR INTERSTITIAL SOLUTE BINDING IN bcc METALS
J. R. Cost and J. T. Stanley 1985 4 p Presented at the Conference on Internal Friction and Ultrasonic Attenuation in Solids, Urbana, Ill., 3 Jun. 1985 Prepared in cooperation with Arizona State Univ., Tempe
(Contract W-7405-eng-36)
(DE85-015705; LA-UR-85-2481; CONF-8506125-6) Avail: NTIS HC A02/MF A01

A Direct Spectrum Analysis (DSA) technique has been applied to key internal friction and elastic after-effect data which are involved in the controversy over the existance of interstitial clustering in the refractory metals. It is found that at relatively high interstitial solute concentrations some of the Snoek peak broadening is due to relaxations that are distinct from the main relaxation. This finding supports the view that interstitial solutes have an interaction that produces clusters of interstitials. DOE

N86-16349# Argonne National Lab., Ill.
ANALYSIS OF THE EFFECTS OF CORROSION POTENTIAL AND IMPURITIES ON THE STRESS CORROSION CRACKING OF TYPE 304 STAINLESS STEEL
P. S. Maiya, T. F. Kassner, and W. E. Ruther Jun. 1985 17 p Presented at the 2nd International Symposium on Environmental Degradation of Materials in Nuclear Power Systems: Water Reactors, Monterey, Calif., 9-1 Sep. 1985; sponsored by ANS, AIME and NACE Sponsored in part by Nuclear Regulatory Commission
(TI85-014964; CONF-850902-2) Avail: NTIS HC A02/MF A01

Intergranular stress corrosion cracking (IGSCC) of sensitized Type 304 stainless steel (SS) has been a recurrent problem in the high-temperature water environment of boiling-water-reactors (BWRs) over the past two decades. The synergistic effects of environmental and material variables on stress corrosion cracking (SCC) of Type 304 SS are investigated at 289C by means of constant-extension-rate-tensile (CERT) tests at a strain rate of 1 x 10 to the -6 power/s. Correlations among environmental variables (dissolved oxygen and impurity concentrations, i.e., H_2SO_4, steady-state open-circuit electro-chemical potential) and the SCC susceptibility parameters are determined. The extensive results over a wide range of open-circuit corrosion potential conditions are analyzed by a model which accounts for the effects of environmental variables, microstructure (i.e., degree of sensitization) and strain rate. The results are consistent with a slip-dissolution mechanism for SCC. Furthermore, representation of the dependence of corrosion potential and average crack growth rate on the dissolved oxygen concentration of the water by a simple mathematical function, in conjunction with the theoretical model, permits predictions of both strain rate and environmental effects on the SCC susceptibility of sensitized Type 304 SS.
Author

N86-16350# Argonne National Lab., Ill. Materials Science and Technology Div.
THE APPLICATION OF ULTRASONIC WAVES TO ASSESS GRAIN STRUCTURE IN CAST STAINLESS STEEL
D. S. Kupperman, K. J. Reimann, and J. Abrego-Lopez Apr. 1985 8 p Presented at the 11th World Conference on Nondestructive Testing, Las Vegas, Nev., 3-8 Nov. 1985 Sponsored in part by Nuclear Regulatory Commission Submitted for publication
(TI85-011475; CONF-851151-1) Avail: NTIS HC A02/MF A01

Ultrasonic inspection is difficult because the microstructure of CSS can vary considerably, from elastically isotropic with equiaxed, relatively small grains to elastically anisotropic with a columnar grain structure to a combination of the two. The results of experiments to characterize the microstructure of CSS by use of ultrasonic waves are discussed. Shear waves may be more effective for isotropic material, whereas longitudinal waves may be better for the anisotropic case because of beam focusing effects. Sound velocity and beam skewing can be measured accurately enough to characterize CSS even in thick walled reactor components.
Author

N86-16351# Argonne National Lab., Ill.
PREDICTION OF ENVIRONMENTAL AND STRAIN-RATE EFFECTS ON THE STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEELS
P. S. Maiya Mar. 1985 32 p Presented at the Symposium on Predictive Capabilities in Environmentally Assisted Cracking, 1985 Winter Annual Meeting of the American Society of Mechanical Engineers (ASME), Miami, Fla., 17-21 Nov. 1985 Sponsored in part by the Nuclear Regulatory Commission, Washington, D.C.
(TI85-012109; CONF-851125-3) Avail: NTIS HC A03/MF A01

The stress corrosion cracking (SCC) susceptibility of austenitic stainless steels in high-temperature water os controlled by environmental variables (e.g., dissolved oxygen, corrosion potential, impurities), microstructure (e.g., degree of sensitization), and strain rate. A phenomenological model based on the slip-dissolution mechanism and elastic-plastic fracture mechanics is presented to quantitatively describe the effects of both environment-related parameters and strain rate on SCC in constant extension rate tests. The model predictions are in good agreement with the results of tests performed on Types 304, 316, and 316NG stainless steel as different strain rates in a wide variety of environments relevant to boiling-water reactors. DOE

N86-16352# Pacific Northwest Lab., Richland, Wash.
PLATINUM-GROUP METALS FROM NUCLEAR REACTIONS AS A POSSIBLE RESOURCE
G. A. Jensen Mar. 1985 21 p Presented at the International Precious Metals Institute Conference and Exhibit, New York, N.Y., 10 Jun. 1985
(Contract DE-AC06-76RL-01830)
(DE85-016277; PNL-SA-12972; CONF-8506176-1) Avail: NTIS HC A02/MF A01

Spent nuclear fuels contain significant quantities of three of

the platinum-group metals (ruthenium, rhodium, and palladium), and a related element technetium, which is nearly absent in nature. Applications for ruthenium, rhodium, and palladium are well established. Since the supply of these and other platinum metals is largely from foreign sources, they are considered strategic materials. Existing and future spent nuclear fuels contain quantities of these platinum metals that exceed the United States reserve base. Technetium has properties similar to platinum metals and has unique, useful properties of its own. The technical feasibility of recovering and using fission product platinum metals (and technetium) extensively in industry depends on: thoroughly decontaminating platinum-group metals from all other radioactive materials in the waste stream; separating platinum-group metals from one another in very high purity; using applications where appropriate control of the residual radioactivity is possible; and whether or not the United States will recover or process spent fuel prior to repository storage. If the radioactivity must be removed, isotope separation or long term storage to allow decay of the contained radioisotopes may be possible. DOE

N86-16353# Allied Bendix Corp., Kansas City, Mo.
CHANNEL PLATING Final Report
M. E. Evans Aug. 1985 21 p
(Contract DE-AC04-76DP-00613)
(DE85-017246; BDX-613-3322) Avail: NTIS HC A02/MF A01

A process was developed for fabricating printed wiring boards with dense (closely spaced, narrow conductors) circuitry. The characteristics of epoxy-glass printed wiring board laminate clad with copper thicknesses of 0.005, 0.009, 0.013, 0.018, and 0.036 mm were compared. The circuitry was defined by a comparatively thick dry-film photoresist which effectively confines the subsequent copper plating for metallization of through-holes) within its channels. Laminate clad with 0.005 and 0.009-mm-thick copper was unsatisfactory because of metallic embedment in the epoxy surface following the etch removal of non-circuitry copper. Material clad with 0.013- and 0.018-mm-thick copper was superior to 0.036-mm cladding in maintaining the integrity of narrow conductors. The 0.018-mm-clad material was more readily available commercially than the 0.013 mm cladding, so the former was chosen for further exploitation. Physical and electrical properties of the laminate material under various environmental conditions were studied. The process that was developed (using laminate clad with 0.018-mm thick-copper, 0.076-mm-thick photoresist and a special ultraviolet light filter for channel perpendicularity) proved to be capable of producing printed wiring boards with 0.127-mm-wide conductors and spacing. A larger scale production feasibility assessment was conducted using printed wiring boards produced by the channel plating process with electronic components attached. DOE

N86-16354# Los Alamos National Lab., N. Mex.
TEMPERATURE KINETICS DURING SHOCK-WAVE CONSOLIDATION OF METALLIC POWDERS
R. B. Schwarz, P. Kasiraj, and T. Vreeland, Jr. 1985 17 p Presented at the EXPLOMET 1985 - International Conference on Metallurgical Applications of Shock Wave and High Strain-Rate Phenomena, Portland, Oreg., 28 Jul. 1985 Prepared in cooperation with International Business Machines Corp., San Jose, Calif. and California Institute of Technology, Pasadena
(Contract W-7405-eng-36)
(DE85-017567; LA-UR-85-2821; CONF-850770-9) Avail: NTIS HC A02/MF A01

Powders (60 (MU)m diam) of constantan and pure copper were compressed statically into cylindrical greens (20.3 mm diam, 5.3 mm long) with a flat interface separating the two powders. A 20-mm propellant gun was used to accelerate a flyer of Lexan, copper, or aluminum, and generate in the green a shock wave with front parallel to the Cu/constantan interface. The voltages between opposite ends of the greens were measured as a function of time and for shock pressures between 1.3 and 9.4 GPa. When the shock wave arrives at the Cu/constantan interface, the voltage signal shows an abrupt increase, which lasts between 45 and 81 ns and leads to a peak temperature T sub p. After this, the hotter and cooler parts of the compact equilibrate and the temperature decreases to a value T sub h. With increasing shock pressure, T sub h increases from 425 to 1215 K. The measurements of T sub h are in excellent agreement with the temperatures calculated from the measured flyer velocity, the Hugoniot for copper powder, and thermodynamic data for the flyer and powders. DOE

N86-16355# California Univ., Berkeley. Lawrence Berkeley Lab.
THERMOMECHANICAL PROCESSING OF A TWO-PHASE Al-Cu-Li-Zr ALLOY
J. Glazer and J. W. Morris, Jr. Jun. 1985 19 p Presented at the 3rd International Aluminum-lithium Conference, Oxfordshire, England, 9 Jul. 1985 Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC03-76SF-00098)
(DE85-017644; LBL-19236; CONF-850777-3) Avail: NTIS HC A02/MF A01

The effect of large second-phase particles on the workability, mechanical properties, and response to thermochemical processing of an Al-2.49Cu-2.37Li-0.13Zr alloy was investigated. The solution-treated alloy was compared with a dispersoid-containing alloy fabricated by aging the base alloy at an intermediate temperature to bring out second-phase particles. Extensive deformation and short heat treatments that cause some of the solute to be incorporated into dispersoid particles were both found to be beneficial to the mechanical properties of the alloy. In specimens which failed intergranularly, the presence of dispersoid particles did not significantly affect the fracture properties. DOE

N86-16356# California Univ., Berkeley. Lawrence Berkeley Lab.
OBSERVATIONS OF PRECIPITATES IN (95)Pb-(5)Sn SOLDER
D. Frear and J. W. Morris, Jr. Jul. 1985 8 p Presented at the Joint Meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society, Louisville, Ky., 5 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE85-017652; LBL-19979; CONF-850840-17) Avail: NTIS HC A02/MF A01

The electronic packaging of integrated circuit chips has been cited as the limiting factor in the performance and reliability of high speed data processing units. A very important part of the package is in the first level where solder bonds the IC chip to a ceramic carrier. The most commonly used first level solder is (95)Pb-(5)Sn. The importance of this solder connection instigated this study of the microstructure of (95)Pb-(5)Sn and its precipitates. DOE

N86-16357# Oak Ridge National Lab., Tenn.
PREPARATION, PROPERTIES, AND SOME RECENT STUDIES OF THE ACTINIDE METALS
R. G. Haire 1985 36 p refs Presented at the ACTINIDES 1985, Aix-en-Provence, France, 1 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017710; CONF-8509147-4) Avail: NTIS HC A03/MF A01

The actinide elements form a unique series of metals. The variation in their physial properties combined with the varying availability of the different elements offers a challenge to the preparative scientist. This article provides a brief review of selected methods used for preparing (micro)g to kg amounts of the actinide metals and the properties of these metals. In addition, some recent studies on selected actinide metals are discussed. DOE

N86-16358# Pacific Northwest Lab., Richland, Wash.
SOME RADIATION DAMAGE-STRESS CORROSION SYNERGISMS IN AUSTENITIC STAINLESS STEEL
R. H. Jones Feb. 1985 7 p Presented at the 2nd International Symposium on Environmental Degradation of Materials in Nuclear Power Systems--Water Reactors, Monterey, Calif., 9 Sep. 1985
(Contract DE-AC06-76RL-01830)
(DE85-017911; PNL-SA-12996; CONF-850902-4) Avail: NTIS HC A02/MF A01

Since radiolytic effects on stress corrosion cracking does not appear to be a major concern, an assessment of the effect of

radiation induced microstructure and microchemistry changes on stress corrosion has been undertaken. The results of two of these evaluations: (1) radiation enhanced creep effects on crack growth rates; and (2) radiation enhanced grain boundary P segregation and IGSCC, are reported in this paper. DOE

N86-16359# Mound Lab., Miamisburg, Ohio.
ELECTROCHEMICAL TECHNIQUES FOR THE ANALYSIS OF CORROSION IN STAINLESS STEEL COMPONENTS. THE 303 STAINLESS STEEL IN CONTACT WITH TATB
D. W. Firsich 21 Aug. 1985 16 p refs
(Contract DE-AC04-76DP-00053)
(DE85-016982; MLM-3286) Avail: NTIS HC A02/MF A01

Electrochemical techniques can be used to predict the corrosion characteristics of a metal in a specific environment. The basic electrochemical principles, experimental techniques, and a detailed study of their use in characterizing the corrosion behavior of a particular 303 stainless steel are presented. The results of the electrochemical corrosion investigation indicated that at room temperature, in a nitrogen atmosphere, using chloride free TATB, the introduction of moisture into the system will not promote significant corrosion. The good corrosion characteristics of 303 SS are lost only when it is exposed to mobile chloride ion, which causes serious pitting/crevice corrosion. The effects of various 303 SS surface finishes upon chloride corrosion resistance were examined; it was shown that a passivation treatment provided only limited protection from chloride attack, and that pitting tended to begin in regions of rougher surface finish. Suggestions for improving the corrosion properties of the system are advanced. DOE

N86-16360# Oak Ridge National Lab., Tenn.
ENGINEERING DATA BASES FOR REFRACTORY ALLOYS
R. H. Cooper, Jr. and W. O. Harms 1985 8 p refs Presented at the 2nd SP-100 Program Integration Meeting, Denver, Colo., 17 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017714; CONF-8509153-2) Avail: NTIS HC A02/MF A01

Refractory alloys based on niobium, molybdenum, tantalum, and tungsten are required for the multi-100kW(e) space nuclear reactor power concepts that have been assessed in the SP-100 Program because of the extremely high temperatures involved. A review is presented of the technology efforts on the candidate refractory alloys in the areas of availability/fabricability, mechanical properties, irradiation effects, and compatibility. Of the niobium-base alloys, only Nb-1Zr has a data base that is sufficiently comprehensive for the high level of confidence required in the reference-alloy selection process for the reactor concept to be tested in the Ground Engineering System (GES) Phase of the SP-100 Program. Based on relatively short-term tests, the alloy PWC-11 (Nb-1Zr-0.1C) appears to have significantly greater creep strength than Nb-1Zr; however, concerns as to whether this precipitation-hardened alloy will remain thermally stable during seven years of full-power reactor operation need to be resolved. Additional information on the reference GES alloy will be needed for the detailed engineering design of a space power system and the fabrication of prototypical GES test components. Expedient development and demonstration of an adequate total manufacturing capability will be required if a high risk of significant schedule slippages and cost overruns is to be avoided. DOE

N86-16361# National Bureau of Standards, Washington, D.C. Metallurgy Div.
SYSTEMATICS OF ALLOYING BEHAVIOR OF THE NOBLE METALS
L. H. Bennett and R. E. Watson 1985 13 p refs Presented at the 114th AIME Annual Meeting (includes Society of Mining Engineers), New York, N.Y., 24 Feb. 1985 Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(Contract DE-AC02-76CH-00016)
(DE86-000031; BNL-37029; CONF-850211-14) Avail: NTIS HC A02/MF A01

The noble metals (Cu, Ag and Au) often behave as a class in alloying with simple metals, metalloids, or transition metals, whether as hosts, in intermetallic compounds, or as dilute impurities. Examples are given of this behavior, as well as noting important differences between the three elements. Hyperfine effects (Knight shifts and isomer shifts), intrinsic elemental effects (electronegativity, structural maps, atomic volumes) and metallic glasses are reviewed. DOE

N86-16362# Cornell Univ., Ithaca, N.Y.
INITIAL STAGES OF OXIDATION OF METALS AND ALLOYS Final Report
J. M. Blakely Aug. 1985 15 p
(Contract DE-AC02-79ER-10501)
(DE86-000732; DOE/ER-10501/08) Avail: NTIS HC A02/MF A01

This project has dealt with the initiation of oxides on single crystal metal surfaces. We have studied the process from the submonolayer adsorption stage to multilayer continuous films. Experiments using LEED, Auger spectroscopy, ellipsometry and RBS have been carried out on Be and Ni single crystals and on Ni-Fe surfaces. DOE

N86-16363# Centre Technique des Industries Mecaniques, Senlis (France).
PASSIVATION OF FASTENER ZINC PROTECTION Final Report [PASSIVATION SUR ZINCAGE DE BOULONNERIE]
H. Bouvier, Ma. Laroche, and B. Sutter Apr. 1984 108 p In FRENCH
(CETIM-102-490) Avail: NTIS HC A06/MF A01

Commercial passivation processes are compared in order to obtain a corrosion resistance > 400 hr for first red staining in salt spray tests. The requirement of an automobile manufacturer was at the origin of this investigation. All 18 commercial processes are above the present 200 hr standard, and color, thickness and treatment times specified. The 400 hr result is not reached by any of the processes. Author (ESA)

N86-16364# Bureau of Mines, Rolla, Mo.
STRENGTHENING LOW-ALLOY MAGNESIUM SHEET BY STRAIN SOFTENING AND ANNEALING
M. M. Tilman, R. L. Crosby, and L. A. Neumeier 1985 20 p refs (PB85-240091; DI-BM-RI-8943) Avail: NTIS HC A02/MF A01 CSCL 11F

The Bureau of Mines conducted research to determine the feasibility of strengthening experimental magnesium-base sheet alloys by strain softening induced by controlled cold rolling followed by selective heat treatment. Relatively small alloying additions having potenital for producing strain softening were selected from metals that are readily available. Tensile properties comparable to mimimum properties of the most commonly used magnesium-base sheet alloy AZ31B, in the H24 condition (strain-hardened and partially annealed), were obtained in an Mg-1MM (mischmetal)-0.5Mn alloy after strain-softening rolling followed by heat treatment. Tensile properties of the experimental alloys in certainconditions are also compared with miminum tensile properties of other standard magnesium sheet alloys. Author (GRA)

N86-16365# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
PITTING CORROSION OF FERROUS ALLOYS
C. Westcott Jan. 1985 53 p
(AERE-R-11490) Avail: NTIS HC A04/MF A01

Failure can occur by a number of mechanisms, one of the most common being pitting corrosion. Pitting corrosion is known to occur in many alloy systems when in contact with a wide variety of environments. Pitting corrosion was investigated with a view to both understanding its mechanism, and preventing its occurrence. The majority of this work has been carried out on ferrous metals, reflecting their pre-eminent position as constructional materials, and their propensity to fall by pitting attack. The literature on this subject is reviewed. Observations in a variety of experimental methods commonly used to investigate pitting corrosion are discussed. The effects of material and environmental parameters

on the pitting process are discussed, and a number of proposed mechanism are described. Author

N86-16366# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
THE INVESTIGATION OF PLUTONIUM AND THORIUM SURFACE CONTAMINATION ON STEELS USING THE MARWELL NUCLEAR MICROPROBE
P. M. Pollard, J. W. McMillan, and F. C. W. Pummery Feb. 1985 38 p
(AERE-R-11698) Avail: NTIS HC A03/MF A01

The contamination of metal surfaces by actinides has been investigated, using the nuclear microprobe, by three analytical methods, namely, Rutherford backscattering, nuclear reaction and particle induced X-ray analysis. A sensitivity of ca 0.01 micro cm for thorium and plutonium on stainless steels was achieved using Rutherford backscattering which gave both areal and depth information. Correlations with the associated substrate elements were sought using nuclear reactions and particle induced X-ray analysis. Computer simulation of backscatter spectra was used to help postulate variations in composition with depth in a plutonium contaminated region. Electron probe analysis proved less sensitive than nuclear microprobe analysis for the measurement of thorium. Both thorium and plutonium contamination on stainless steel surfaces was found to be patchy and associated with optically observable features. Little or no contamination was observed on rolling marks and shallow scratches although light contamination does agglomerate at larger physical defects, possibly pits. Heavy plutonium contamination has been found to be associated with, and to penetrate into, light element inclusions. DOE

N86-16367# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
APPLICATION OF A MODEL FOR STRESS DRIVEN SEGREGATION TO HYDROGEN EMBRITTLEMENT
C. L. Briant and C. A. Hippsley May 1985 10 p
(AERE-R-11596) Avail: NTIS HC A02/MF A01

A model developed to describe the stress-assisted segregation of embrittling impurities to crack tips during stress-relief cracking at elevated temperatures has been applied to hydrogen assisted cracking. The model correctly predicted the form of the experimentally determined pressure and temperature dependence of hydrogen assisted crack growth, with realistic levels of calculated crack tip hydrogen coverage. DOE

N86-16368# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
THE SOLIDIFICATION AND TRANSFORMATION BEHAVIOUR OF A NIOBIUM-STABILISED AUSTENITIC STAINLESS STEEL WELD METAL
R. M. Boothby Mar. 1985 32 p
(AERE-R-11646) Avail: NTIS HC A03/MF A01

Microstructural examination of an autogeneous 17Cr-12Ni-1Mo-0.2Nb weld has revealed that solidification occurred as both primary ferrite and primary austenite. Compositional profiles in the weld, determined by STEM/EDX analysis, and calculated diffusion distances indicate that the transformation of delta-ferrite to austenite occurred by a diffusional process during cooling. Niobium stabilization appears to restrict M23C6 formation and promote the transformation of retained delta-ferrite to intermetallic phases, including sigma, chi, laves and R-phase, during subsequent elevated temperature ageing of the weld. DOE

N86-16369# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
METALLURGICAL OBSERVATIONS OF A FRENCH A508 CLASS 3 FORGING WITH RESPECT TO TRANSITION TOUGHNESS BEHAVIOUR
S. G. Druce, J. M. Titchmarsh, G. Jordan, and A. James Apr. 1985 46 p
(AERE-R-11626) Avail: NTIS HC A03/MF A01

A detailed chemical, microstructural and fractographic examination has been conducted on three large fracture toughness specimens chosen to represent the bounds of toughness at 5 C observed in a thick-section A508 Class 3 steel forging. Bulk and local chemical analyses show little variation between specimens and agreed well with data previously obtained from this and other similar forgings. Local regions of solidification segregation enriched with Mo, Mn, Ni, S, P, Si and Cr, and several square millimeters in section, were identified beneath the fracture plane of all three specimens, varying in number density and area fraction inversely with toughness. Microstructural analysis revealed a number of particle types, namely M3C, M2C, M23C6 and AlN, which had been observed previously in similar investigations on pressure vessel plates and forgings, together with an unidentified Mo-Fe phase not previously reported. Some variation in the particle types and size distribution occurred between specimens with higher densities of large M23C6 carbides and small Mo-Fe particles being associated with low toughness. DOE

N86-16370# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
THE INFLUENCE OF CARBIDE TRANSFORMATIONS ON THE GRAIN BOUNDARY SEGREGATION OF PHOSPHOROUS IN QUENCHED AND TEMPERED 2 1/4Cr-1 PERCENT Mo STEEL
G. Gage Mar. 1985 43 p
(AERE-R-11462; FRDCC/MWG(85)P112;
FRDCC/MWG/MPSG(85)P59) Avail: NTIS HC A03/MF A01

Auger electron spectroscopy has been used to study the grain boundary chemistry in a commercial 2 1/4%Cr-1%Mo steel following ageing at 500 C to promote the segregation of impurities. Particular attention has been focused on the influence of the prior tempering treatment on the development of segregation through its affect on the carbide population and matrix composition. Fracture of the prior austenite grain boundaries was associated with the enrichment of the four elements, phosphorus, molybdenum, chromium and carbon at this location. However, inert-ion sputtering experiments indicated that only phosphorus was present in a segregated form and the presence of others was attributed to the precipitation of molybdenum- and chromium-containing carbides on the boundaries. The segregation of the phosphorus was determined to be equilibrium in nature while its coverage of the grain boundaries following ageing at 500 C was demonstrated to be sensitive to prior tempering treatment. Prolonging the tempering treatment and/or lowering the tempering temperature promoted an increase in the propensity for phosphorus to segregate plus formation of the more stable alloy carbides, in particular the molybdenum-rich equilibrium carbide M6C. DOE

N86-16371# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
EFFECT OF STRENGTH AND PRECIPITATION ON THE MECHANISMS OF HYDROGEN EMBRITTLEMENT IN 2 1/4-Cr1Mo STEEL
M. I. Thomas and C. A. Hippsley Jan. 1985 28 p
(AERE-R-11474) Avail: NTIS HC A03/MF A01

The effect of material strength on the propensity to embrittlement by hydrogen of 2 1/4 CrlMo steel was investigated. Tensile test pieces were quenched and tempered at 550C for up to 500 hours, after which, specimens were tested in the uncharged and electrolytically hydrogen charged condition. It was found that tensile strength remained virtually unaffected by the presence of hydrogen, although the reduction of area and strain to failure were severely affected. Examination of fracture surfaces revealed that specimens in the uncharged condition exhibited microvoid coalescence and shear modes, while hydrogen charged material exhibited brittle intergranular and cleavage modes at high strengths. Tempering to a lower strength level resulted in the complete disappearance of brittle modes and the appearance of a quasi-cleavage fracture mode which involved a significant degree of plastic deformation. This transition from brittle to ductile modes of hydrogen embrittlement was found to be coincident with the onset of M2C carbide precipitation. Author

N86-16372# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.

STRESS RELIEF CRACKING OF 9Cr STEELS CONTAINING 0 TO 2 PERCENT MOLYBDENUM
C. A. Hippsley, C. L. Briant (General Electric, Schenectady, N.Y.), and B. C. Edwards Feb. 1985 32 p
(AERE-4-11737; FRDCC/MWG/P(85)160; FRDC/MWG/MPSG/P(85)75; FRDC/MWG/FSG/P(85)25) Avail: NTIS HC A03/MF A01

The stress relief cracking (SRC) susceptibility of a range of 9Cr steels of varying Mo (0 to 2 wt%) and trace impurity content (P,S) have been assessed using a 4-point bend test procedure. Two distinct modes of cracking were identified in the P-doped 9Cr steel similar to those observed previously in commercial casts of 2 1/4 Cr 1MO. At low temperatures (550 to 650 C), a low ductility intergranular failure was produced, characterized by relatively high rates of crack growth < 10 to the minus 6 power (MS) and associated with the grain boundary segregation of trace impurities. At higher temperatures, a ductile intergranular fracture was produced. The addition of molybdenum to the steel had a marked effect on the SRC response, eliminating the lower temperature brittle mode of failure and reducing the tendency to form ductile cavities. It is considered that this is due to the formation of delta ferrite promoted by the molybdenum additions. The commercial 9Cr 1Mo steel studied only exhibited a slight degree of cavitational-type cracking in material quenched from a high peak temperature (1320 C). This material was much less susceptible to cracking than the wide range of alloy steels previously studied using the same experimental procedure. DOE

N86-16373# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
AN INTRODUCTION TO THE ac IMPEDANCE TECHNIQUE AND ITS APPLICATION TO CORROSION PROBLEMS
D. E. Williams and C. C. Naish Feb. 1985 26 p
(AERE-M-3461) Avail: NTIS HC A03/MF A01

An outline of the basis of the ac impedance technique is given, and some examples of its application to the study of corrosion processes described. The results are complex and can easily be over-interpreted. Noting the number of relaxation times and their value and observing the change in these and the extrapolated dc resistance with solution conditions is all that is needed, or justified. The technique clearly provides a powerful addition tool for probing the behavior of corroding systems. Author

N86-16374# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD CORROSION HANDBOOK. VOLUME 1: CORROSION, CAUSES AND CASE HISTORIES
W. Wallace (National Research Council, Ottawa, Canada), D. W. Hoeppner (Toronto Univ.), and P. V. Kandachar (Fokker, Schiphol, Netherlands) Jul. 1985 205 p refs
(AGARD-AG-278-Vol-1; ISBN-92-835-1505-6) Avail: NTIS HC A10/MF A01

A need exists to keep aircraft operators and maintenance personnel aware of the science and technology of corrosion as it applies to aircraft structures. Information is provided on the aircraft operating environment, corrosion theory, common airframe materials and their response to corrosion, the detection of corrosion, and methods employed to control corrosion in aircraft structures and materials. Also given are case histories of the deterioration or failure of components in typical aircraft and the means of detection are detailed and the remedical action taken. Microbiological corrosion is also discussed. The handbook is intended to assist in the early diagnosis of developing corrosion problems and in the selection of appropriate corrective measures. Author

N86-16436# Joint Publications Research Service, Arlington, Va.
ELECTROPLATING PROCESS EQUIPMENT PROFILED
Karol Patorski and Jerzy Strzelecki *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 40-42 Repr. from Polish Technical Review (Warsaw, Poland), no. 2-3, 1985 p 13-14 (For primary document see N86-16432 07-31) Avail: NTIS HC A04/MF A01

N86-16448# University of Electro-Communications, Tokyo (Japan).
COMPUTER CONTROLLED PREPARATION OF SEVERAL METAL COMPLEXES-1
Nobuhide Kokubu, Akira Yamasaki, Hiroya Shiraki, Hiroshi Togashi, Masaki Yasumoto, and Yasuhiro Yamanaka *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 81-85 In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32) Avail: NTIS HC A10/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-16375# Pennsylvania State Univ., University Park.
THE USE OF DELOCALIZED CARBANIONS IN THE PREPARATION OF NEW MONOMERS AND POLYMERS Ph.D. Thesis
Mitchell Blumenthal 1985 66 p
Avail: Univ. Microfilms Order No. DA8515998

The chemistry of delocalized carbanions was shown to offer considerable potential for the facile synthesis of new monomers, polymers and initiators. A series of monomers and polymers based on the substitution of 2,3-dimethyl-1,3-butadiene via the 2,3-dimethylene-1,3-dianion were synthesized. Included in these studies are the following: (1) Disubstituted butadienes and 1,-4-butanediols; (2) Monomer containing crown ethers; and (3) Delocalized carbanions were shown to be excellent anionic initiators with the number of growing chains from the site of initiation being equal to the charge on the carbanion. This represents a new procedure for preparing telechelic, linear and star polymers. In summary, the delocalized carbanion chemistry shown has led to the formation of a number of new monomers and polymers. Dissert. Abstr.

N86-16376 Massachusetts Univ., Amherst.
A MORPHOLOGICAL STUDY OF A SERIES OF MULTIARMED STAR BLOCK COPOLYMERS OF POLYISOPRENE AND POLYSTYRENE Ph.D. Thesis
David Brian Alward 1985 255 p
Avail: Univ. Microfilms Order No. DA8517075

An elucidation of the influence of molecular topology on the development of equilibrium phase separated morphologies in multi-armed star block coplymer systems is presented. Small angle X-ray scattering and electron microscopy were the principal techniques used to directly and indirectly probe the morphologies. The studies were augmented by transport measurements and dynamic mechanical thermal analysis. The samples studied were of constant composition with 30 weight percent polystyrene at the free of the arm and 70 weight percent polyisoprene at the center. The star molecules examined had 2, 4, 8, 12, or 18 arms, and total arm molecular weights of 2.3, 3.3 and 10 x 10 the 4.
Dissert. Abstr.

N86-16377 Cincinnati Univ., Ohio.
PHOSPHOSILICATE GLASS FOR INTEGRATED OPTICS Ph.D. Thesis
Ahmed Naumaan 1985 226 p
Avail: Univ. Microfilms Order No. DA8516110

The use of phosphosilicate glass (PSG) films prepared by chemical vapor deposition is investigated for the fabrication of integrated optical waveguide structures. PSG layers deposited on V- grooves etched in silicon substrates were annealed in a furnace under a variety of conditions involving annealing ambients, temperatures and times. Laser annealing of PSG layers using a CO2 laser was also investigated. Laser heat treatment also resulted flow of the phosphosilicate glass. The scattered light intensity method and a three prism method for making loss measurements on waveguides are analyzed in terms of possible sources of error in making measurements as well as analyzing the data using regression procedures. Analysis of a closed loop

resonator with a tapered mode input coupler is presented. The fabrication procedure for the resonator design implemented using PSG channel waveguides is described and experimental evidence of resonant behavior is presented. Dissert. Abstr.

N86-16378 British Library Lending Div., Boston Spa (England).
DETERMINATION OF RHEOLOGICAL COEFFICIENTS OF SUPERPLASTIC MATERIALS
M. A. Tsepin, A. N. Ershov, and D. V. Yukhtanov [1985] 6 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii Chernaya Metallurgiya (USSR),
(BLL-M-36430-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The least-squares and coordinate descent methods were used to calculate the rheological coefficients of different alloys. Data from various mechanical tests were used as the initial data. Obtained dependences of dimensionless flow stresses on dimensionless deformation rate characterize quantitatively the main laws governing the influence of chemical composition, temperature, and grain size on the behavior of materials in the state of superplasticity. Author

N86-16379*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF A THIOETHER LUBRICANT BY INFRARED FOURIER MICROEMISSION SPECTROPHOTOMETRY
William R. Jones, Jr., Wilfredo Morales, and James L. Lauer (Rensselaer Polytechnic Inst., Troy, N.Y.) Jan. 1986 16 p refs
(NASA-TM-87195; E-2691; NAS 1.15:87195) Avail: NTIS HC A02/MF A01 CSCL 11H

An infrared Fourier microemission spectrophotometer is used to obtain spectra (wavenumber range, 630 to 1230 0.1 cm) from microgram quantities of thioether lubricant samples deposited on aluminum foil. Infrared bands in the spectra are reproducible and could be identified as originating from aromatic species (1,3-disubstituted benzenes). Spectra from all samples (neat and formulated, used and unused) are very similar. Additives (an acid and a phosphinate) present in low concentration (0.10 percent) in the formulated fluid are not detected. This instrument appears to be a viable tool in helping to identify lubricant components separated by liquid chromatography. Author

N86-16380*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OPTICALLY TRANSPARENT/COLORLESS POLYIMIDES
Anne K. StClair, Terry L. StClair, Wayne Slemp, and Keziban S. Ezzell (PRC Kentron Inc., Hampton, Va.) Dec. 1985 41 p refs Presented at 2nd International Conference on Polyimides, Oct. 30 - Nov. 1 1985, Ellenville, N.Y.; sponsored by Society of Plastics Engineers
(NASA-TM-87650; NAS 1.15:87650) Avail: NTIS HC A03/MF A01 CSCL 11B

Several series of linear aromatic polyimide films have been synthesized and characterized with the objective of obtaining maximum optical transparency. Two approaches have been used as part of this structure-property relationship study. The first approach is to vary the molecular structure so as to separate chromophoric centers and reduce electronic interactions between polymer chains to lower the intensity of color in the resulting polymer films. A second and concurrent approach is to perform polymerizations with highly purified monomers. Glass transition temperatures of thermally cured polyimide films are obtained by thermomechanical analysis and thermal decomposition temperatures are determined by thermogravimetric analysis. Transmittance UV-visible spectra of the polyimide films are compared to that of a commercial polyimide film. Fully imidized films are tested for solubility in common organic solvents. The more transparent films prepared in this study are evaluated for use on second-surface mirror thermal control coating systems. Lightly colored to colorless films are characterized by UV-visible spectroscopy before and after exposure to 300 equivalent solar hours UV irradiation and varying doses of 1 MeV electron irradiation. The effects of monomer purity, casting solvent and cure atmosphere on polyimide film transparency are also investigated. Author

N86-16381*# Dow Corning Corp., Midland, Mich.
ORGANOSILOXANE WORKING FLUIDS FOR THE LIQUID DROPLET RADIATOR Final Report
R. R. Buch and A. R. Huntress Dec. 1985 174 p refs
(Contract NAS3-24400)
(NASA-CR-175033; NAS 1.26:175033) Avail: NTIS HC A08/MF A01 CSCL 11G

Siloxane-based working fluids for advanced space radiators requiring direct fluid exposure to the space environment are evaluated. Isolation of five candidate fluids by vacuum distillation from existing siloxane polymers is discussed. The five fluids recovered include a polydimethylsiloxane, three phenyl-containing siloxanes, and a methylhexylsiloxane. Vapor pressures and viscosities for the five fluids are reported over the temperature range of 250 to 400 K. Use of thermal-gravimetric analysis to reliably estimate vapor pressures of 10 to the -8 power Pascals is described. Polydimethylsiloxane (PDMS) and polymethylphenylsiloxane (PMPS) are selected from the five candidate fluids based on favorable vapor pressure and viscosity, as well as perceived stability in low-Earth orbit environments. Characterization of these fluids by infrared spectroscopy, Si-29 NMR, gel-permeation chromatography, and liquid chromatography is presented. Both fluids consist of narrow molecular weight distributions, with average molecular weights of about 2500 for PDMS and 1300 for PMPS. Author

N86-16382# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
PERFLUOROPOLYALKYLETHER OIL DEGRADATION: INFERENCE OF FeF3 FORMATION ON STEEL SURFACES UNDER BOUNDARY CONDITIONS
D. J. Carre 1 Aug. 1985 24 p
(Contract F04701-83-C-0084)
(AD-A159261; TR-0084A(5945-03)-3; SD-TR-85-37) Avail: NTIS HC A02/MF A01 CSCL 11/8

The formation of iron fluoride (FeF3) through the interaction of Kaytox 143AB perfluoropolyalkylether (PFPE) oil with steel surfaces was investigated under boundary lubrication conditions. Ball-bearing rolling action was simulated by a specially designed wear-test apparatus that incorporated noncoaxial wear members to give a skid/roll ratio of approx. 0.16. The contact stress was 830,000,000 sq m (approx. 120,000 psi), and the speed was 1750 rpm. Under these conditions, FeF3 formation on the wear surfaces was inferred using X-ray photoelectron spectroscopic (XPS), Auger electron spectroscopic (AES), and secondary ion mass spectrometric (SIMS) surface analysis techniques. These findings support the hypothesis that, under the low oxygen environment of spacecraft Earth orbit, formation of FeF3 and subsequent FeF3 catalyzed degradation of PFPE can constitute an important PFPE degradation pathway under boundary lubrication conditions. GRA

N86-16383# Honeywell, Inc., New Hope, Minn. Ceramics Center.
CRACK PROPAGATION IN Z5U MULTILAYER DIELECTRICS Technical Report, 1 Jun. 1983 - 31 May 1984
K. D. McHenry and B. G. Koepke 1 May 1985 29 p
(Contract N00014-83-C-0141)
(AD-A159262; AD-E301788; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

It has been found that moisture has a deleterious effect in enhancing slow crack growth in Z5U multilayer ceramics similar to the effect shown in other ceramic materials. The enhancement of slow crack growth in the presence of moisture has been demonstrated for both parallel and perpendicular orientations of the multilayer structure with respect to the propagating crack. The application of dc electric fields to the multilayer ceramics either has no effect or serves to retard crack propagation depending upon the crack orientation with respect to the applied electric field. The fracture toughness or critical stress intensity factor as

measured by the double torsion testing technique has been found to vary with respect to orientation of the multilayer structure. Higher fracture toughness values are obtained when the macroscopic crack is forced to propagate in a direction perpendicular to the multilayer structure. GRA

N86-16384# Aeronautical Research Labs., Melbourne (Australia).
CHARACTERISTICS OF RAPID CURE MAGNETIC RUBBER INSPECTION FORMULATIONS
B. C. Bishop Apr. 1985 36 p
(AD-A159398; ARL-MAT-TM-390) Avail: NTIS HC A03/MF A01 CSCL 11/10

Magnetic rubber inspection (MRI) is a form of magnetic particle inspection. In this particular form the magnetic particles are suspended in a liquid rubber curing at room temperature. The rubber, after the addition of a catalyst and a stabilizer, is poured into, or around, the area to be inspected, where it may be contained, if necessary, by a specially constructed reservoir. A magnetic field, complying with the principles of magnetic particle inspection, is then applied to the part for a period of approximately 2 to 4 minutes, after which the rubber solution continues to cure to the solid state. The flexible solid rubber cast is then removed from the part and the surface of the cast is examined in detail, in the relevant areas, using a low-power binocular microscope. Evidence of surface and near-surface defects in the material with which the rubber was in contact during the curing/magnetization period appears at the surface of the cast as corresponding concentrations of magnetic particles. Over the last 10 years the magnetic rubber inspection method has proved very useful for the detection of very small (0.2mm surface length) fatigue cracks and other surface discontinuities (e.g., non-metallic inclusions) in magnetic materials. In many instances, it has been the only method whereby such defects could be detected non-destructively. The introduction of rapid-cure magnetic rubber inspection formulations has raised questions as to whether there may be some impairment of the sensitivity and reliability of the inspection technique relative to its performance with the well-established, slower curing formulation. This memorandum attempts to answer these questions. GRA

N86-16385# Materials Research Labs., Ascot Vale (Australia).
CONVERSION OF HYDRAULIC BRAKE SYSTEMS FROM POLYGLYCOL TO SILICONE BRAKE FLUID: RESIDUAL POLYGLYCOL REMAINING AFTER CONVERSION
P. J. Sanders and J. Barry Jun. 1985 20 p
(AD-A159501; MRL-TN-491) Avail: NTIS HC A02/MF A01 CSCL 11/8

Selected Australian Army vehicles were converted from polyglycol to silicone brake fluid using experimental flush-fill techniques. Performance trials and analysis of samples taken after conversion indicate that techniques associated with the conversion do not remote all polyglycol from the vehicles tested. Accordingly, the technical advantages possible from the use of silicone fluids are not achieved. Author (GRA)

N86-16386# Oak Ridge National Lab., Tenn.
FABRICATION OF CERAMIC-CERAMIC COMPOSITES BY CHEMICAL VAPOR DEPOSITION
D. F. Stinton, W. J. Laskey, R. J. Lauf, and T. M. Besmann 1984 17 p Presented at conference
(Contract DE-AC05-84OR-21400)
(DE85-000981; CONF-840171-1) Avail: NTIS HC A02/MF A01

Toughened ceramic composites were produced by the simultaneous chemical vapor deposition of two phases. Fracture toughness values were nearly double the value of SiC when CH3SiCl3 and TiCl4 vapors were used to produce SiC-TiSi2 composites. Other systems consisting of SiC and the metal or metal carbides of Ni, Cr, W, and Mo were examined. Equilibrium thermodynamic analyses of these systems were performed as a function of the chemical vapor deposition variables: temperature, total pressure, and reactant concentration. Thermodynamic calculations also indicated that SiC and TiC should be codeposited when CH3SiCl3, TiCl4, and a hydrocarbon are used as the coating gases. Author

N86-16387# Department of Energy, Washington, D. C.
METHOD OF FORMING A FOAMED THERMOPLASTIC POLYMER Patent Application
D. V. Duchane (Los Alamos National Lab., N. Mex.) and D. L. Cash, inventors (to DOE) (Los Alamos National Lab., N. Mex.) Filed 21 Nov. 1984 11 p
(Contract W-7405-eng-36)
(DE85-017772; US-Patent-Appl-SN-673968) Avail: NTIS HC A02/MF A01

A solid thermoplastic polymer is immersed in an immersant solution comprising a compatible carrier solvent and an infusant solution containing an icompatible liquid blowing agent for a time sufficient for the immersant solution to infuse into the polymer. The carrier solvent is then selectively extracted, preferably by a solvent exchange process in which the immersant solution is gradually diluted with and replaced by the infusant solution, so as to selectively leave behind the infustant solution permanently entrapped in the polymer. The polymer is then heated to volatilize the blowing agent and expand the polymer into a foamed state. DOE

N86-16388# Department of Energy, Washington, D. C.
INORGANIC-POLYMER-DERIVED DIELECTRIC FILMS Patent Application
C. J. Brinker (Sandia National Labs., Albuquerque, N. Mex.), K. D. Keefer (Sandia National Labs., Albuquerque, N. Mex.), and P. M. Lenahan, inventors (to DOE) (Sandia National Labs., Albuquerque, N. Mex.) Filed 25 Feb. 1985 45 p
(Contract DE-AC04-76DP-00789)
(DE85-017763; US-Patent-Appl-SN-704697) Avail: NTIS HC A03/MF A01

A method is disclosed for coating a substrate with a thin film of a predetermined porosity. The method comprises: depositing the thin film on the substrate from a non-gelled solution comprising at least one metal alkoxide of a polymeric network forming cation, water, an alcohol compatible with the hydrolysis and the polymerization of the metal alkoxide, and an acid or a base; prior to said depositing step, controlling the porosity and structure of said coating for a given composition of said solution exclusive of the acid or base component and the water component, by adjusting each of the water content, the pH, the temperature and the time of standing of said solution, increasing/decreasing the water content or the pH to increase/decrease the pore size of said coating, and increasing/decreasing the temperature or time of standing of said solution to increase/decrease the pore size of said coating; and curing said deposited film at a temperature effective for curing whereby there is obtained a thin film coating of a predetermined porosity on the substrate. DOE

N86-16389# Department of Energy, Washington, D. C.
SYNTHESIS OF NEW AMORPHOUS METALLIC SPIN GLASSES Patent Application
R. C. Haushalter, inventor (to DOE) (Argonne National Lab., Ill.) Filed 11 Feb. 1985 9 p
(Contract W-31-109-eng-38)
(DE85-017800; US-Patent-Appl-SN-700845) Avail: NTIS HC A02/MF A01

Amorphous metallic precipitates with the formula (M1) sub a (M2) sub b wherein M1 is at least one transition metal, M2 is at least one main group metal and the integers a and b provide stoichiometric balance are disclosed. The precipitates have a degree of local order characteristic of chemical compounds from the precipitation process and useful electrical and mechanical properties. DOE

N86-16390# National Bureau of Standards, Washington, D.C. Center for Building Technology.
MOLECULAR AND MICROSTRUCTURAL FACTORS AFFECTING MECHANICAL PROPERTIES OF POLYMERIC COVER PLATE MATERIALS
E. J. Clark Jul. 1985 65 p
(Contract DE-AI01-76PR-06010)
(DE85-016820; NBSIR-85-3197) Avail: NTIS HC A04/MF A01

The dependence of mechanical properties of polymers on various microstructural factors is reviewed. The microstructural and molecular factors considered are: molecular weight, crystallinity, crosslinking, branching, copolymerization, plasticization, orientation, and residual stresses. The types of mechanical properties considered are: direct loading, fatigue, creep, wear and abrasion, and environmental stress cracking. The effects of polymer deformation and fraction at the molecular level are discussed. Cracking, crazing, and shear yielding are described. Polymeric cover plate materials are discussed and their degradation reviewed. Methods to measure microlevel changes in polymers are identified. DOE

N86-16391# Mound Lab., Miamisburg, Ohio.
HIGH STRENGTH GLASS-CERAMIC TO METAL SEALS
L. D. Haws, D. P. Kramer, W. E. Moddeman, and G. W. Wooten 1985 41 p refs Presented at the American Institute of Chemical Engineers National Meeting, Seattle, Wash., 25 Aug. 1985
(Contract DE-AC04-76DP-00053)
(DE85-017422; MLM-3288(OP); CONF-850836-6) Avail: NTIS HC A03/MF A01

In many applications, ceramics are joined to other materials, especially metals. In such cases, interfacial strength is as important as the strength of each constituent material. Examples are presented for tailoring materials and processes to optimize the glass-ceramic to metal seal. Means for detecting defects, nondestructively, are also identified. DOE

N86-16392# Department of Energy, Washington, D. C.
FABRICATION OF LOW DENSITY CERAMIC MATERIAL Patent Application
T. T. Meek, R. D. Blake, and H. Sheinberg, inventors (to DOE) Filed 1985 11 p
(Contract W-7405-eng-36)
(DE85-017766; US-Patent-Appl-SN-668054) Avail: NTIS HC A02/MF A01

A precursor mixture and a method of making a low-density ceramic structural material are disclosed. The precursor mixture includes hollow microballoons, typically made of glass, together with a cementing agent capable of being cured by microwave irradiation. A preferred cementing agent is liquid hydrated potassium silicate, which is mixed with the glass microballoons to form a slurry. Upon irradiation the potassium silicate is dehydrated to form a solid porous matrix in which the microballoons are evenly distributed. Ground glass or other filling agents may be included in the slurry to enhance the properties of the final product. Low-density structural ceramics having densities on the order of 0.1 to 0.3 are obtained. DOE

N86-16393# National Bureau of Standards, Boulder, Colo.
ROUND ROBINS ON THE APPARENT THERMAL CONDUCTIVITY OF LOW-DENSITY GLASS FIBER INSULATIONS USING GUARDED HOT PLATE AND HEAT FLOW METER APPARATUS
J. G. Hust and C. M. Pelanne May 1985 131 p refs
(Contract DE-AC05-84OR-21400)
(DE85-017253; NBSIR-85-3026) Avail: NTIS HC A07/MF A01

This National Bureau of Standards report presents the results and the data analysis pertaining to these results for three round robins on the thermal performance of guarded hot plates and heat flow meters when measuring the thermal resistance properties of low density glass fibrous thermal insulations. The three round robins were carried out under the sponsorship of the American Society for Testing and Materials (ASTM) Subcommittee C-16.30 on Thermal Measurements and the Mineral Insulation Manufacturers Association (MIMA). The test results are compared to a reference equation and to each other to illustrate intralaboratory and interlaboratory reproducibility as well as the dependencies on temperature, density, plate emittance, specimen thickness, and fiber diameter. The study shows that, with good laboratory practices, interlaboratory agreement of about 2% is obtained. Over 300 test results obtained by 12 different laboratories are reported. This report also discusses the magnitude of the specimen thickness effect and its dependence on plate emittance. DOE

N86-16394# Lawrence Livermore National Lab., Calif.
VARIATION OF TRANSMITTANCE SPECTRA OF POROUS ANTIREFLECTION COATINGS WITH INDEX PROFILE
D. Milam and G. G. Peterson 30 May 1985 36 p Presented at the Boulder Damage Symposium, Colorado, 15 Oct. 1985
(Contract W-7405-eng-48)
(DE85-013976; UCRL-91430; CONF-8510101-1) Avail: NTIS HC A03/MF A01

Transmittance spectra were calculated for single-layer coatings with: (1) homogeneous refractive index; (2) index profiles that increase monotonically with distance into the coating; and (3) index profiles that rise in discrete steps. The calculations predict that large transmittance at tuned wavelengths can be obtained using any of these coating designs and known, porous silica coating materials. The spectral bandwidth of transmittance maxima increases when the index profile is altered from homogeneous to any profile whose index increases monotonically with thickness in the coating. Bandwidth is greatest for the linear-ramp coating whose index rises linearly from that of air to that of the substrate, but this design cannot currently be used because we are unable to fabricate silica coating material with the extremely large porosity needed to provide a coating index near unity at the air interface. For currently attainable fractional silica contents, estimated to be in the range 0.4 to 0.5, the optimum handwidth is provided by a coating with a single discrete step in its index profile. DOE

N86-16395# Oak Ridge National Lab., Tenn.
PREPARATION OF BACKTHINNED CERAMIC SPECIMENS
A. T. Fisher and P. Angelini 1985 2 p Presented at the Joint Meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society, Louisville, Ky., 5 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016588; CONF-850840-12) Avail: NTIS HC A02/MF A01

Backthinned specimens of ion-implanted single-crystal Al_2O_3 have been prepared by first protecting the implanted surface with NaCl. This protects against contamination of the back surface by impurities sputtered during the ion milling step in the backthinning process. The specimens can then be analyzed using analytical electron microscopy. DOE (Author)

N86-16396# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SPECULARITY AND STABILITY OF SILVERED POLYMERS
A. W. Czanderna and P. Schissel Jul. 1985 13 p Presented at SPIE International Technical Symposium on Optical and Electro-Optical Engineers, San Diego, Calif., 18 Aug. 1985
(Contract DE-AC02-83CH-10093)
(DE85-012156; SERI/TP-255-2743; CONF-850887-13) Avail: NTIS HC A02/MF A01

Silvered polymers have been studied for possible mirror applications in concentrators for solar thermal systems. The polymeric mirrors were prepared by vacuum evaporating or dc-sputtering silver onto several candidate polymers for use as second surface mirrors. Specularities were measured at 7 and 15 mrad acceptance angles at 660 nm. The specularity of silvered poymers depends strongly on ther topography and bulk properties of the polymer used. It is independent both of the deposition rate from 0.1 to 7 nm/s and from thermal evaporation and dc-sputtering processes. Silvered glass specularities are also independent of deposition rates from 0.1 to 45 nm/s and are typically 93% at 7 mrad. The specularity does not depend on the substrate temperatures during depositions for the range of 5 C to about 100 C. In some cases, a metallic film was deposited onto the silver before mounting onto a Corning 7809 glass substrate. Inconel backing of films from 35 to 150 nm thick does not reduce the specularity of silvered polymers at 15 mrad, but does accelerate the degradation of the multilayer combination during accelerated or real-time weathering. After measuring the solar-weighted hemispherical reflectance and the second surface specularity at 660 nm for acceptance angles of 15 and 7 nrad, the silvered

polymeric specimens were subjected to accelerated testing in a Weather-Ometer at 60 C, 80% relative humidity, and UV radiation, or in a QUV at 40 C, UV irradiation, and condensation cycles. Real-time testing has also been carried out in the suburban Denver Atmosphere. With exposure, all mirrors prepared show evidence for some or extensive optical and/or visual degradation. The relative durabilities of the various combinations studied are discussed in terms of the silvering method, polymer used, metallic backing for the silver, and adhesive used for mounting the silvered polymer onto a test substrate. DOE

N86-16397# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
POLYMER SYNTHESIS AND MODIFICATION RESEARCH DURING FY 1984
H. H. Neidlinger and P. Schissel Jul. 1985 73 p
(Contract DE-AC02-83CH-10093)
(DE85-012160; SERI/TR-255-2590) Avail: NTIS HC A04/MF A01

This paper reports on our evaluation and modification of polymeric glazings to protect silver mirrors. The mirrors were made using Corning 7809 glass as a substrate onto which a thin silver film is deposited. The modified polymeric films are then cast from solution onto the silver. The mirrors were characterized by measuring the hemispherical reflectance and the specular reflectance at 660 nm and selected acceptance angle (15 mr or 7 mr). The mirrors were exposed to environmental degradation using accelerated weathering devices and outdoor exposure. Empirical evidence has demonstrated that polymethylmethacrylate is a stable polymer in a terrestrial environment, but the polymer does not provide adequate protection for the silver reflector. The crucial role in degradation played by ultraviolet (UV) light is shown by several experimental results. We have demonstrated that UV stabilizers added to the polymer improve the weatherability of mirrors. The relative effectiveness of different stabilizers will be discussed in terms of the weathering modes, retention of optical properties, and effectiveness of the weathering modes, retention of optical properties, and effectiveness of the additives. DOE

N86-16398# Oak Ridge National Lab., Tenn.
FRACTURE TOUGHNESS OF ANISOTROPIC GRAPHITES
C. R. Kennedy and M. T. Kehne 1985 2 p Presented at the 17th Bien. Conference On Carbon, Lexington, Ky., 16 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016595; CONF-8506108-2) Avail: NTIS HC A02/MF A01

Fracture toughness measurements were made at 0, 30, 45, 60, and 90 degrees from the extrusion axis on a resonably anisotropic graphite, grade AGOT. It was found that the fracture toughness did not vary appreciably with orientation. An observed variation in strength was found to be the result of defect orientation. DOE

N86-16399# Union Carbide Corp., New York.
PROCEDURE FOR THE PRODUCTION OF LINEAR THERMOPLASTIC POLYMERS FROM THE BREAKDOWN PRODUCTS OF PYROLYSIS OF p-XYLENE-BIS-SULFONES
1985 21 p Transl. into ENGLISH of Dutch Patent No. 6611019 (Sept. 1964)
(Contract W-7405-eng-36)
(DE85-017024; LA-tr-85-37) Avail: NTIS HC A02/MF A01

This invention concerns the analysis of p-xylene-bis-sulfones. The invention concerns in particular the pyrolytic analysis of p-xylene-bis-sulfones and the polymers prepared by this process. Purpose of this invention is also to create p-xylylene polymers, where the vulnerable hydrogen atoms lying on the border of the aromatic ring are replaced by another more stable substitute, which increases the total stability of the polymers. Another object of the invention is to create a procedure for the preparation of p-xylylene polymers by suitable means. Another object of the invention is to produce (ALPHA), (ALPHA), (ALPHA)', (ALPHA)'-tetrafluor-p-xylylene polymers. DOE

N86-16400# New Mexico Inst. of Mining and Technology, Socorro. Center for Explosives Technology Research.
DYNAMIC COMPACTION OF SiC POWDER
Tamotsu Akashi, Victor Lotrich, Akira Sawaoka, and Edwin K. Beauchamp (Sandia National Labs., Albuquerque, N. Mex.) 1985 6 p Presented at conference
(DE85-016802; SAND-85-1647C; CONF-850736-60) Avail: NTIS HC A02/MF A01

Dynamic compaction techniques have considerable potential in the consolidation and fabrication of hard-to-density powder materials such as non-oxide ceramic materials. Consolidation of the powder materials by this technique involves the densification of the powder at the shock wave front followed by interparticle bonding which occurs during the shock-compression process. Recently, a series of shock-compaction experiments on fine SiC powder have been performed by Kondo, et al. Sintered compacts with densities of 97% of theoretical and micro-Vieker's hardness values of 2700 kg/sq. mm. were produced. It was suggested that the disruptive effects, indicated by microstrain increase and crystallite size reduction, must remain in the compacted sample in order to obtain a well-bonded compact. The compaction mechanism of coarse SiC powder in the dynamic compaction process, which may be different from that of the fine powder, is studied. Author

N86-16401# Oak Ridge National Lab., Tenn.
DEVELOPMENT OF CERAMIC TURBINE ROTORS
Yoshito Kobayashi, Norio Nakazawa, and Tohji Inagaki 1985 11 p Translated from Proceedings of the 13th Regular Gas Turbine Conference, June 1985 p 59-64 Prepared in cooperation with Mitsubishi Motors Corp., Tokyo, Japan
(Contract DE-AC05-84OR-21400)
(DE85-017021; ORNL-tr-5223) Avail: NTIS HC A03/MF A01

Mitsubishi Motor Company has been developing gas turbines for use in trucks and is, at the present time, conducting tests using metal turbines. Mitsubishi Motor Company has also performed engine tests at 1120(0)C turbine inlet temperature (TIT) using a metal air-cooled turbine. On the basis of these tests, the possibility of using gas turbines for high-performance automotive engines has been demonstrated. The only weak point was that fuel consumption was not economical when compared to that of current diesel engines. In order to eliminate this weakness, it is necessary for truck engines to raise the TIT to above 1250(0)C, and it is therefore essential that ceramics be used. Mitsubishi is developing gas turbines with ceramic turbine rotors, which hold the key to realization of high-efficiency gas turbines for use in automobiles and trucks. The hot spin test process for silicon nitride radial-flow turbine rotors is discussed. DOE

N86-16402# Oak Ridge National Lab., Tenn.
EVALUATION OF THE STRENGTH OF CERAMIC RADIAL TURBINE ROTORS
Masanori Sasaki, Takao Izumi, Seiji Ajiwa, and Takane Ito 1985 13 p Translated from Proceedings of the 13th Regular Gas Turbine Conference, June 1985 p 65-70 Prepared in cooperation with Nissan Motor Co. Ltd., Tokyo, Japan
(Contract DE-AC05-84OR-21400)
(DE85-017022; ORNL-tr-5224) Avail: NTIS HC A03/MF A01

The development of turbine rotors that are subjected to high temperature and centrifugal force is one of the most difficult development problems for ceramic parts used for ceramic gas turbines in passenger cars. One of the authors has attempted to evaluate the strength of a small silicon nitride turbine rotor on the basis of 3-point bar breaking strength using the Weakest Link Theory. A bar breaking test was conducted on a test piece cut out of the actual rotor. A spin strength evaluation was then attempted on the basis of the test results. After continual analysis of causes and improvements in the rotors that fail at a spin speed less than the predicted speed, a few insights have been gained that will contribute to the development of the ceramic radial turbine rotor. DOE

N86-16403# Tennessee Univ., Knoxville. Dept. of Chemistry.
STATISTICAL MECHANICS OF POLYMER SYSTEMS

Annual Report
J. Kovac 1 May 1985 8 p
(Contract DE-FG05-84ER-45114)
(DE85-017986; DOE/ER-45114/1) Avail: NTIS HC A02/MF A01

In the original proposal three areas of research were outlined: development of models for isolated polymer chain dynamics using projection operator techniques; study of the effect of entanglements on the dynamics polymer chains by means of computer simulation; and nonequilibrium thermodynamic and statistical mechanical theories of the glass transition. During the past eight months almost all of our efforts have been focused on computer simulation. The original single chain simulation algorithm has been extended to multiple chain systems in order to study the effects of interchain entanglements on the chain dynamics. In addition, we have performed a normal coordinate analysis of the dynamics of single chains in order to further elucidate the effect of excluded volume on the chain motion. The current status of our computer simulation research is described. A brief description of plans for research in theories of the glass transition is also given. DOE

N86-16404# Sandia National Labs., Albuquerque, N. Mex.
LINEAR THEORY FOR POROUS THERMOELASTIC MATERIALS
D. F. McTigue 10 Sep. 1985 52 p
(Contract DE-AC04-76DP-00789)
(DE86-000222; SAND-85-1149) Avail: NTIS HC A04/MF A01

A linear theory for fluid-saturated, porous, thermoelastic media is developed. The theory allows for compressibility and thermal expansion of both the fluid and solid constituents. An approach to solving boundary value problems is presented in which a diffusion equation with a temperature-dependent source term governs a combination of the mean total stress and the fluid pore pressure. In certain special cases, this reduces to a diffusion equation for the pressure alone. In addition, when convective heat transfer can be neglected, the temperature field can be determined independently, and the source term in the pressure equation is known. Drained and undrained limits are identified, in which fluid flow plays no role in the deformation. In the drained case, the medium behaves as a simple thermoelastic body with the properties of the porous skeleton with no fluid present. In the undrained limit, the fluid is trapped in the pores, and the material responds as a thermoelastic body with effective compressibility and thermal expansivity determined in part by the fluid properties. The theory is further specialized to plane and one-dimensional deformations, and several illustrative problems are solved. In particular, the one-dimensional heating of a half-space is explored for constant-temperature and constant-flux boundary conditions on the thermal field, and for drained (zero pressure) and impermeable (zero flux) conditions on the fluid pressure field. Finally, solutions are presented for constant heat flux delivered to a borehole for both drained and impermeable boundaries. The behavior of all of these solutions depends critically upon the ratio of the fluid and thermal diffusivities, with very large and very small values of this parameter corresponding to drained and undrained responses, respectively. DOE

N86-16405# Fermi National Accelerator Lab., Batavia, Ill.
CRYOGENIC COMPRESSIVE PROPERTIES OF BASIC EPOXY RESIN SYSTEMS
F. W. Markley, J. A. Hoffman, and D. P. Muniz Sep. 1985 9 p Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985
(Contract DE-AC02-76CH-03000)
(DE86-000647; FNAL-TM-1347; CONF-850814-11) Avail: NTIS HC A02/MF A01

The compressive properties of short cylindrical samples of many different epoxy resin systems have been measured at ambient temperature and at 77K. These are pure resin systems of known chemistry, without the inorganic fillers or fibrous reinforcements needed in final cryogenic systems. Of course, chemically incorporated modifiers such as flexibilizing resins have been included. These data should make possible inferences about cryogenic properties from molecular structures and provide specific data useful to formulators and end users. Measurements on some other plastics such as PTFE, Polyimides, and UHMWPE have been made for comparison purposes. DOE

N86-16406# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
CERAMIC MATERIALS FOR SENSOR WINDOWS
Knut-Fredrik Alm Sep. 1985 29 p refs In SWEDISH; ENGLISH summary
(FOA-C-20583-F9; ISSN-0347-3694) Avail: NTIS HC A03/MF A01

Literature on high temperature ceramics suitable for electro-optic and electromagnetic windows was reviewed. About 20 ceramics, oxides, silicates, and (oxy-) nitrides have the properties to make them suitable as sensor windows. Important factors for the choice of these materials are: effectiveness in a narrow wavelength bandwidth; resistance to thermal shock such as the heat arising on adiabatic compression in nose cones; erosion resistance against rain and particles; and thermal expansion. Author (ESA)

N86-16407# National Bureau of Standards, Gaithersburg, Md. Inorganic Materials Div.
COMPUTERIZED FRZCTURE MECHANICS DATABASE FOR OXIDE GLASSES Final Technical Note
S. W. Freiman, T. L. Baker, and J. B. Wachtman Jun. 1985 95 p Prepared in cooperation with Rutgers - The State Univ., Piscataway, N.J.
(PB85-227080; NBS/TN-1212) Avail: NTIS HC A05/MF A01; SOD HC $3.50 as 003-003-02663-8 CSCL 11B

Values of critical fracture toughness, fracture energy, subcritical crack growth exponents and Young's modulus, are compiled and tabulated for a wide variety of oxide glasses. A computerized data retrieval system has been formulated to allow for selection of data by either glass composition, investigator, or experimental technique, and year. GRA

N86-16431# Joint Publications Research Service, Arlington, Va.
THERMAL CONDUCTIVITY OF POLYURETHANE FOAM AT LOW TEMPERATURE
Zhu Xian, Ji Yongfu, Bai Pinxian, and Han Yuanzhou *In its* China Report: Science and Technology (JPRS-CST-85-039) 13 Nov. 1985 p 44-62 refs Transl. into ENGLISH from Yuhang Xuebao (Beijing, China), no. 2, 30 Apr. 1984 p 54-65 Original language document was announced in IAA as A84-43357 (For primary document see N86-16429 07-31)
Avail: NTIS HC A07/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-16408# Coordinating Research Council, Inc., Atlanta, Ga.
1982 CRC FUEL RATING PROGRAM: ROAD OCTANE PERFORMANCE OF OXYGENATES IN 1982 MODEL CARS
Jul. 1985 205 p
(AD-A159127; CRC-541) Avail: NTIS HC A10/MF A01 CSCL 21/4

Because of the widespread interest in the use of alcohols and ethers as gasoline blending components, the present program was conducted to evaluate the effects of several oxygenates on gasoline octane performance and to evaluate the effects of car design features such as engine and transmission type. Five oxygenates were evaluated at two nominal concentrations, 5 and 10 volume percent, at both regular- and premium-grade octane levels: methanol (MeOH), ethanol (ETOH), isopropanol (IPA), tertiary butanol (TBA), and methyl tertiary butyl ether (MTBE). A

blend of 5 percent MeOH and 5 percent TBA was also tested at both octane levels. Twenty-eight unleaded fuels, including four hydrocarbon fuels, two hydrocarbon fuels plus toluene, and twenty-two oxygenated fuels, were rated in duplicate in thirty-eight cars using the Modified Uniontown Technique (CRC Designation F-28-75 described in Appendix C), plus some additional instructions. All testing was done on chassis dynometers. Ratings were obtained at full throttle with all thirty-eight cars, and at the most critical part-throttle condition (occurring with manifold vacuum of 4 in. Hg (13.5 kPa) or greater above the full-throttle vacuum) with nine cars. GRA

N86-16409# Sandia National Labs., Albuquerque, N. Mex.
MODELING AND COMPUTATION OF DEFLAGRATION-TO-DETONATION TRANSITION IN REACTIVE GRANULAR MATERIALS
M. R. Baer, R. E. Benner, R. J. Gross, and J. W. Nunziato 1985 31 p Presented at the 17th AMS-SIAM Summer Seminar in Applied Mathematics, Ithaca, N.Y., 30 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-016160; SAND-85-0397C; CONF-8506169-1) Avail: NTIS HC A03/MF A01

In this paper, we present a multiphase flow model of the combustion of a gas permeable reactive granular material. In particular, we focus on a model of the physical-chemical processes associated with the transition from deflagration to detonation in granular explosives and propellants. Two numerical strategies are discussed that are aimed toward multidimensional computations. Comparison of our results with experimental data for the explosives CP and HMX suggests that a thermodynamically consistent model can describe the flame spread processes associated with convective burning, compressive deflagration, and detonation. DOE

N86-16410# Department of Energy, Washington, D. C.
SEMICONDUCTOR BRIDGE (SCB) IGNITER Patent Application
R. W. Bickes, Jr. (Sandia Labs., Albuquerque, N. Mex.) and A. C. Schwarz, inventors (to DOE) (Sandia Labs., Albuquerque, N. Mex.) Filed 19 Feb. 1985 40 p
(Contract DE-AC04-76DP-00789)
(DE85-017806; US-Patent-Appl-SN-702716) Avail: NTIS HC A02/MF A01

A semiconductor device is described which is capable of fast, low energy initiation (really detonation) of high explosives. A strongly crystalline structure is used having semiconductor properties such that it has a sharp inflection point at which the change from extrinsic to intrinsic conduction occurs, whereby resistivity decreases sharply. At this point, a shock wave is released capable of detonating a high explosive. This turnover point is allegedly controlled by controlling the doping level of the semiconductor and matching it with the desired autoignition temperature for the specific explosion involved. B.W.

N86-16411# Mound Lab., Miamisburg, Ohio.
MECHANISM OF FAILURE OF TWO PYROTECHNIC COMPONENTS
A. C. Munger and C. M. Woods 1985 21 p refs Presented at the International Pyrotechnics Society Symposium, Karlsruhe, West Germany, 3 Jul. 1985
(Contract DE-AC04-76DP-00053)
(DE85-017421; MLM-3291(OP); CONF-850742-2) Avail: NTIS HC A02/MF A01

An investigation of two unrelated pyrotechnic test device misfires revealed an ignition phenomenon that helps to explain the well-known necessity of maintaining good integrity between bridgewire and powder in hot-wire devices that use insensitive pyrotechnic powders. The factor common to both devices was the TiH/sub 1.65/:KC104 in a 33:67 weight percent ratio. This material is being used because of its high static insensitivity, a characteristic that makes good bridgewire contact mandatory for reliable ignition. Extensive work with a scanning electron microscope revealed that not only does the bridgewire require entrapment, but the initiation reaction gases must be contained within the immediate vicinity of the bridgewire or the initiation will not be sustained. Evidence is presented to document the phenomenon that caused the misfire of both components that were investigated. DOE

N86-16412# Sandia National Labs., Albuquerque, N. Mex.
MICROWAVE INTERFEROMETER TECHNIQUES FOR DETONATION STUDY
P. L. Stanton, E. L. Venturini, and R. W. Dietzel 1985 10 p refs Presented at the 8th International Symposium on Detonation, Albuquerque, N. Mex., 15 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-018536; SAND-85-1928C; CONF-850706-31) Avail: NTIS HC A02/MF A01

Techniques have been developed to improve resolution in microwave interferometry of detonating explosives. Unwanted reflections in the measurement arm of the interferometer result in phase distortion of the recorded signal. By using tuning techniques, unwanted reflections can be virtually eliminated, and phase distortion is minimized, for some experimental conditions. The use of a quadrature detector and an intensity monitor also improve the resolution of the interferometer. Data obtained in several detonation experiments are presented and interpreted. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-16413*# Astro Aerospace Corp., Carpinteria, Calif.
HIGH-PERFORMANCE DEPLOYABLE STRUCTURES FOR THE SUPPORT OF HIGH-CONCENTRATION RATIO SOLAR ARRAY MODULES Final Report
Mehran Mobrem 31 Oct. 1985 79 p refs
(Contract NAS8-36043)
(NASA-CR-176394; NAS 1.26:176394) Avail: NTIS HC A05/MF A01 CSCL 13B

A study conducted on high-performance deployable structures for the support of high-concentration ratio solar array modules is discussed. Serious consideration is being given to the use of high-concentration ratio solar array modules or applications such as space stations. These concentrator solar array designs offer the potential of reduced cost, reduced electrical complexity, higher power per unit area, and improved survivability. Arrays of concentrators, such as the miniaturized Cassegrainian concentrator modules, present a serious challenge to the structural design because their mass per unit area (5.7 kg/square meters) is higher than that of flexible solar array blankets, and the requirement for accurate orientation towards the Sun (plus or minus 0.5 degree) requires structures with improved accuracy potentials. In addition, use on a space station requires relatively high structural natural frequencies to avoid deleterious interactions with control systems and other large structural components. The objective here is to identify and evaluate conceptual designs of structures suitable for deploying and accurately supporting high-concentration ratio solar array modules. R.J.F.

N86-16414# Naval Civil Engineering Lab., Port Hueneme, Calif.
HANDBOOK FOR MARINE GEOTECHNICAL ENGINEERING. DEEP OCEAN TECHNOLOGY Final Report, Oct. 1979 - Dec. 1983
K. Rocker, Jr. Mar. 1985 260 p
(AD-A157894; AD-E900470) Avail: NTIS HC A12/MF A01 CSCL 13/2

This handbook discusses the application of engineering techniques and scientific knowledge to the investigation of sea-floor materials, their characteristics, and their responses to foundation and mooring loads. Its primary thrust is with problems engineers will encounter beyond the continental shelf or below 600 feet, but the information is also applicable to shallow water tasks. GRA

N86-16415# Defense Mapping Agency, Washington, D.C.
SOME OPERATIONAL ASPECTS OF INERTIAL SURVEYING SYSTEMS Final Report
M. Macomber and L. Pfeifer Aug. 1985 7 p
(AD-A158956) Avail: NTIS HC A02/MF A01 CSCL 17/7

The surveying community has now accumulated about a decade of experience with the development, testing and operational use of inertial surveying systems. Tremendous progress has been made in identifying error sources and developing operational procedures to minimize or eliminate them, or devising means to correct for them. Even so, there remain three errors which are viewed as impediments to the efficient and effective application of inertial technology to precise surveying. The intent of this overview is to stimulate discussion and creative thought in order to hasten the development of some means of compensating for the underlaying problems. Author (GRA)

N86-16416# Allied Bendix Corp., Kansas City, Mo.
MULTIPLE LEAD-ELECTRICAL DISCHARGE MACHINING Final Report
R. W. Brockhoff Aug. 1985 32 p
(Contract DE-AC04-76DP-00613)
(DE85-016330; BDX-613-3285) Avail: NTIS HC A03/MF A01

Multiple lead-electrical discharge machining (ML-EDM) was investigated to develop the capability and demonstrate the feasibility of applying state-of-the-art electrical discharge machining (EDM) to the manufacturing of mechanical hardware. Two parts selected for the machining tests were a titanium component container and a stainless steel valve mounting plate. Numerous combinations of ML-EDM and conventional EDM tests were conducted on each part, and the results were evaluated for comparison. In all test cases, the cutting time savings of ML-EDM surpassed the conventional EDM by as much as 42%, and when compared to numerical control (NC) milling, a 75% reduction was achieved. A dimensional analysis revealed that the ML-EDM and conventional EDM were similar, but when compared to the NC milled parts, the ML-EDM parts were superior. When the surface finish comparisons were evaluated, the ML-EDM part surfaces were considerably better at higher material removal rates than those of the conventional EDM process. The investigation also revealed an important fact concerning the number of parts to be machined in a single setup. DOE

N86-16417# Sandia Labs., Albuquerque, N. Mex.
VACUUM ARC REMELTING: AN OVERVIEW
F. J. Zanner and L. A. Bertram 1985 41 p refs Presented at the 8th International Conference on Vacuum Art Metallurgy, Linz, Austria, 30 Sep. 1985
(Contract DE-AC04-76DP-00789)
(DE85-016458; SAND-85-1509C; CONF-8509136-1) Avail: NTIS HC A03/MF A01

Vacuum arc remelting (VAR) is a casting process for producing uniform ingots. This paper discusses: arc physics and behavior, metal transfer and electrode gap measurement, boundary conditions on crucible wall, and pool dynamics and macrosegregation. Materials discussed are Inconel 718 and U-6% Nb alloy. DOE

N86-16418# Sandia National Labs., Albuquerque, N. Mex.
HAZARDS IN HIGH PRESSURE SYSTEMS
T. G. Priddy Aug. 1985 13 p refs
(Contract DE-AC04-76DP-00789)
(DE85-015490; SAND-85-1700) Avail: NTIS HC A02/MF A01

The High Pressure Systems Committee (HPSC) of the American Society of Mechanical Engineers is writing a set of rules and guides which will eventually be approved for treatment of safety concerns in high pressure operations. An introductory section of the proposed standard is being written to describe the hazards in high pressure. This paper is an edited version of the early draft of that section which is numbered 2000. Taking Section 2000 out of context (separately printing it from the remainder of the proposed standard) poses a possible misunderstanding in that high pressure is not necessarily synonymous with a lack of safety. There are many high pressure systems in operation with very acceptable safety records. However, when the potential for damage is great, it becomes more essential that safety be comprehensively engineered and practiced. Everyone concerned should be aware to some degree of the dangers that could happen in such operations. This paper is written in an attempt to share the concerns (appraisal of the risks) that members of the HPSC have for high pressure as interpreted and edited by this author. DOE

N86-16419# Allied Bendix Corp., Kansas City, Mo.
ECONOMICS OF FABRICATING PLASTIC PREFORMS BY ROBOTICS
E. M. Lundgren Aug. 1985 14 p
(Contract DE-AC04-76DP-00613)
(DE85-017247; BDX-613-3284) Avail: NTIS HC A02/MF A01

A robotic work cell consisting of a process robot, an automatic weigh feeder, and an existing plastic pill making machine was developed. This work cell was released September 13, 1983, for production use. Although the work cell was designed and planned for operation in an operator-unattended mode, renovation and rearrangement of the work area made it necessary to assemble the work cell in the Robot Application Center Annex and to implement its initial use in production as an operator-attended work cell. Because the work cell is located in an area distant from the normal work area, an operator cannot monitor this and other equipment conveniently. As of September 1, 1984, the plastic pill making robot work cell has produced 80,428 pills in 752.8 hours, a reduction of 683.4 hours from the 1436.2 hours manual operation would have required. The next step in the development of automated pill making will occur when the work cell is relocated into the production department with a new pill press. Projections for future savings of $20,866 annually are based on a reduction of 1448 labor hours. DOE

N86-16420# Oak Ridge National Lab., Tenn.
PERFORMANCE OF THE IFSMTF HELIUM REFRIGERATOR IN PARTIAL-ARRAY TESTS
S. W. Schwenterly, W. A. Fietz, R. E. Stamps, and J. F. Ellis 1985 10 p Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017312; CONF-850814-3) Avail: NTIS HC A02/MF A01

Performance of the International Fusion Superconducting Magnet Test Facility (IFSMTF) helium refrigerator in Partial Array Tests with three coils is described. The refrigerator was able to cool the coils and facility structure to 4.2 K in 20 days, with maximum temperature differentials of less than 50 K. Boiloff measurements were made for several components; only the lead dewars showed losses substantially higher than expected. Forced-flow cooling tests were also conducted. The coils and facility were warmed back to room temperature in 30 days. Several repairs and improvements were carried out. Results of another recent test on the refrigerator alone are reported. DOE

N86-16421# Fermi National Accelerator Lab., Batavia, Ill.
OPERATIONAL HISTORY OF FERMILAB'S 1500 W REFRIGERATOR USED FOR ENERGY SAVER MAGNET PRODUCTION TESTING
A. J. Bianchi, R. K. Barger, F. B. Johnson, K. J. McGuire, K. D. Pinyan, F. W. Wilson, and W. E. Cooper Sep. 1985 9 p refs Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985
(Contract DE-AC02-76CH-03000)
(DE86-000641; FNAL-TM-1353; CONF-850814-17) Avail: NTIS HC A02/MF A01

The 1500 W helium refrigerator system utilizes two oil-injected screw compressors staged to feed a liquid nitrogen precooled cold box. Refrigeration is provided by two Sulzer TGL-22 magnetic/gas bearing turbines. The refrigerator feeds six magnet test stands via a 10,000 L dewar and subcooler equipped distribution box. The design of the controls has permitted the system to be routinely operated 24 hours/day, 7 days/week with only five operators. It

has operated approximately 90% of the 4.5 years prior to shutting down in 1984 for a period of 1 year to move the compressor skid. Scheduled maintenance, failures, repairs and holidays are about equal to the 10% off time. The equipment described was used to test approximately 1200 superconducting magnets for the Fermilab accelerator ring. The 7 year operating experience is presented as an equipment and technique review. Compressor hours currently exceed 42,000 and turbine hours exceed 39, 000 each. Failure rates, causes, preventive maintenance, monitoring practices and equipment, and modifications are examined along with notes on some of the more successful applications of technique and equipment. DOE

N86-16422# Fermi National Accelerator Lab., Batavia, Ill.
5cm, NO IRON SSC DIPOLE 12m MODEL CRYOSTAT THERMAL PERFORMANCE
R. J. Powers, J. D. Gonczy, J. Otavka, R. C. Niemann, A. Szymulanski, and J. L. Tague Sep. 1985 9 p refs Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985
(Contract DE-AC02-76CH-03000)
(DE86-000642; FNAL-TM-1352; CONF-850814-15) Avail: NTIS HC A02/MF A01

A 12 m long model of a 5 cm costheta dipole cryostat has been constructed and its thermal performance measured. The model utilized heat intercepted fiberglass reinforced plastic posts to support the 12 m long, 4.5 K cold mass and the 10 and 80 K thermal shields. A superinsulation blanket system utilizing aluminized polyester with fiberglass mat spacing material was developed and installed on the 10 and 80 K thermal shields. The heat gain to 4.5, 10 and 80 K was measured. We have compared the results with the analytical predicted performance and it shows good agreement. The performance of the multilayer insulation system has been measured under several different system conditions and the results are reported. DOE

N86-16423# Sandia National Labs., Albuquerque, N. Mex.
DEPENDENCE OF CHARGE MATERIAL TEMPERATURE ON DIE TEMPERATURE DURING UNIAXIAL HOT PRESSING
R. H. Moore, R. G. Easterling, and J. R. Hellmann Aug. 1985 28 p refs
(Contract DE-AC04-76DP-00789)
(DE86-000828; SAND-85-0092) Avail: NTIS HC A03/MF A01

The temperature response of several hot press dies and their charge materials were monitored from room temperature to an elevated temperature range. Induction heated TZM dies, and resistance heated TZM, silicon carbides, and alumina dies were investigated. From the collected data, equations were derived which can be used to predict the charge temperature based on direct measurement of the die temperature. With induction heating, predicting in the 600 to 1300C range are hindered by large variations in the data. However, at 1400 to 1700C more precise predictions are possible. With resistance heating, highly precise predictions can be made throughout the 600 to 1200C range. DOE

N86-16424# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).
[ACTIVITIES REPORT IN ELECTRICAL SCIENCE] Annual Report, 1984
Apr. 1985 186 p refs
Avail: NTIS HC A09/MF A01

Research in acoustics; electromechanics; photometry; systems engineering; materials science; electrical metrology; and time, frequency and electromagnetic metrology is summarized. Television communication; image processing; standards; and calibration techniques are studied. Author (ESA)

N86-16425# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
MECHANISTIC DESIGN CONCEPTS FOR CONVENTIONAL FLEXIBLE PAVEMENTS Interim Report
R. P. Elliott and M. R. Thompson Feb. 1985 129 p Sponsored by Illinois State Dept. of Transportation, Springfield
(PB85-224517; UILU-ENG-85-2001; TE-Ser-42; FHWA/IL-85/208) Avail: NTIS HC A07/MF A01 CSCL 13B

Mechanical design concepts for convetional flexible pavement (asphalt concrete (AC) surface plus granular base/subbase) for highways are proposed and validated. The procedure is based on ILLI-PAVE, a stress dependent finite element computer program, coupled with appropriate transfer functions. Two design criteria are considered: AC flexural fatigue cracking and subgrade rutting. Algorithms were developed relating pavement response parameters (stresses, strains, deflections) to AC thickness, AC moduli, granular layer thickness, and subgrade moduli. Extensive analyses of the AASHO Road Test flexible pavement data are presented supporting the validity of the proposed concepts. Author

N86-16426# Transportation Research Board, Washington, D.C.
RELIABILITY OF GEOTECHNICAL INSTRUMENTATION
W. H. Hansmire, V. C. McGuffey, J. B. Hannon, K. A. Jackura, and L. W. Abramson 1985 58 p
(PB85-235950; TRB/TRR-1044; ISBN-0-309-03814-6; LC-85-13779) Avail: NTIS HC A04/MF A01 CSCL 08M

Several topics related to the reliability of geotechnical instrumentation are discussed. Reliability of pore pressure measurement; measurement of earth pressure; reliability of strain gauges and load cells for geotechnical engineering applications; some facts about long-term reliability of vibrating wire intruments; instrumentation reliability at Harvard Square Station; and instrumentation for load transfer in socketed pier foundations; are among the topics covered. Author

N86-16427# Pennsylvania Transportation Inst., University Park.
EVALUATION OF PAVEMENT TEXTURE Final Report, Sep. 1981 - Mar. 1984
J. J. Henry, J. C. Wambold, and X. Huihua Oct. 1984 77 p
(Contract DTFH61-81-C-00063)
(PB85-242550; PTI-8321; FHWA/RD-84/016) Avail: NTIS HC A05/MF A01 CSCL 13B

A system for pavement macrotexture measurement was evaluated. The system utilizes the principle of depolarization of reflected polarized light. The output of the system, the depolarized light number (DPN), is compared with other measures of pavement texture: sand-patch mean texture depth (MTD), British pendulum number (BPN), and outflow meter time (OFT) for 22 asphalt concrete sites and 5 portland cement concrete sites. The prediction of texture data from simultaneous measurements of ribbed and blank-tire skid resistance data was investigated. Using the two-tire data, it is possible to predict sand-patch mean texture depth (MTD) and Bristish pendulum number (BPN). Comparison of the two-tire data at accident sites demonstrates the potential to screen for wet weather accident sites by means of pavement surveys with the two tires. GRA

N86-16428# Transportation Research Board, Washington, D.C.
SURFACE PROPERTIES-VEHICLE INTERACTION
D. L. Huft, I. Her, S. K. Agrawal, R. A. Zimmer, and C. J. Bester 1984 62 p
(PB85-242576; TRB/TRR-1000; ISBN-0-309-03809-X; LC-85-10046) Avail: NTIS HC A04/MF A01 CSCL 13B

Several topics related to the surface properties of aircraft runways are discussed. The South Dakota profilometer; development of a data acquisition method for noncontact pavement macrotexture measurement; the traction of an aircraft tire on grooved and porous asphaltic concrete; holes in the pavements; the effect of pavement type and condition on the fuel consumption of vehicles; the traction loss of a suspended tire on a sinusoidal road; the effect of vehicle and driver characteristics on the psychological evaluation of road roughness; the correlation of subjective panel ratings of pavement ride quality with profilometer-derived measures of pavement roughness; a microprocessor-based noncontact distance measuring control system, and, the representation of pavement surface topography in predicting runoff depths and hydroplaning potential are discussed. DOE

N86-16429# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
13 Nov. 1985 126 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-85-039) Avail: NTIS HC A07/MF A01

Various topics related to science and technology efforts in China are discussed. Solar observatories, polyurethane foam, pressure measurement, cyclotrons, and microcomputers are discussed. For individual titles, see N86-16430 through N86-16431.

N86-16430# Joint Publications Research Service, Arlington, Va.
AUTOMATIC GATHERING, PROCESSING OF MULTIPOINT PRESSURE DATA ANALYZED **c34**
Zhou Xinghua *In its* China Report: Science and Technology (JPRS-CST-85-039) 13 Nov. 1985 p 35-43 refs Transl. into ENGLISH from Tianjin Daxue Xuebao (Tianjin, China), no. 2, Dec. 1984 p 115-120 (For primary document see N86-16429 07-31)
Avail: NTIS HC A07/MF A01

A device using a TP801 microcomputer as its main unit, and microtransducers CYG, A/D converter (Multichannel Voltmeter PF 3), I/O interface circuit and miniprinter TP 801 as its accessories is discussed. The automatic gathering and processing of multipoint pressure data can be made according to the software and the measurement result can be printed in real time. It can replace the manual calculation of measuring multipoint pressure data with a multitube manometer. As a result, the measuring speed and accuracy can be greatly enhanced. Fitted with different transducers and accompanied with appropriate software, this device can also measure other physical quantities and process their appropriate data. Author

N86-16431# Joint Publications Research Service, Arlington, Va.
THERMAL CONDUCTIVITY OF POLYURETHANE FOAM AT LOW TEMPERATURE **c27**
Zhu Xian, Ji Yongfu, Bai Pinxian, and Han Yuanzhou *In its* China Report: Science and Technology (JPRS-CST-85-039) 13 Nov. 1985 p 44-62 refs Transl. into ENGLISH from Yuhang Xuebao (Beijing, China), no. 2, 30 Apr. 1984 p 54-65 Original language document was announced in IAA as A84-43357 (For primary document see N86-16429 07-31)
Avail: NTIS HC A07/MF A01

The heat-insulation mechanism of polyurethane foam is investigated. The relationship between the low-temperature thermal conductivity and certain parameters which can easily be measured at room temperature (such as density, fraction of closed cells, average cell diameter, and aging time, etc.) is determined. Calculations of the effective thermal conductivity based on room-temperature measurements and an analytical computational model yield results in agreement with experimental findings. Author

N86-16432# Joint Publications Research Service, Arlington, Va.
EAST EUROPE REPORT: SCIENCE AND TECHNOLOGY
2 Dec. 1985 71 p Transl. into ENGLISH from various East European articles
(JPRS-ESA-85-036) Avail: NTIS HC A04/MF A01

East Europe Report: Science and Technology (JPRS - ESA - 85 - 036), 2 December 1935, contains Science and Technology Reports from the literature of the following Eastern European countries: the German Democratic Republic, Hungary, Poland and Romania. Of particular interest in this issue are articles on robot production in Hungary, and silicon semiconductor, electroplating process equipment, and composite electric contact materials developments in Poland. For individual titles, see N86-16433 through N86-16437.

N86-16433# Joint Publications Research Service, Arlington, Va.
PROSPECTS OF MAKING, BUYING, USING ROBOTS VIEWED **c37**
Gitta Takacs *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 23-27 Transl. into ENGLISH from Figyelo (Budapest, Hungary), no. 39, 27 Sep. 1985 p 6 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

A number of Hungarian enterprises is now dealing with robot development. In general, the starting point is the purchase of a foreign license, the adaptation and further development of which serve as a basis for manufacture. For example, the Bakony Works is making simple assembly manipulators on the basis of a W. German license, the Mosonmagyarovar Metal Fittings Factory is making a manipulator system to serve die-casting machines, the Custom Machine Factory of the Csepel Works has begun manufacture of robots on the basis of a Japanese license, and the Rekard Agricultural Machine Manufacturing Enterprise in Gyor has purchased as Austrian license. For the time being large series manufacture--one thousand--is being done only in the Gyongyos factory of the Microelectronics Enterprise for a very special applications area, robots to move color television picture tubes, primarily for Soviet export. Elsewhere they are still at the prototype level, or have started with a series of only ten or so units, for the domestic and socialist market. At the end of 1983 the statistics indicated there were 40 robots in use in our country; at present about 70 are in operation, some of them work continually in manufacturing systems, and a good number of them are used for development or as reference systems for development. In the next ten years, some 1500 robots will be put into operation in Hungary. F.M.R.

N86-16434# Joint Publications Research Service, Arlington, Va.
VAMOS VIEWS NEEDS FOR ROBOT PRODUCTION **c37**
G. T. *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 30-34 Transl. into ENGLISH from Figyelo (Budapest, Hungary), no. 39, 27 Sep. 1985 p 7 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

A robot is the product of a relatively complex machine industry; where such a machine industry exists robots can be produced. This technological level can be called only moderate in Hungary. The newest robots operate with a precision of a tenth of a millimeter or better, with great speed and acceleration, with extraordinarily precise adjustment characteristic curves, free of vibration. The design strength in Hungary today is not sufficient to make one like that. The other condition is the price. Large technological robots still cost many tens of thousands of dollars, even a hundred thousand dollars. Operating these in Hungary could pay off only in very rare cases. A robot is no more complex a tool than a modern automobile, and in time there will be no need for it to cost more. Of course, to do this they must be manufactured in very large numbers and with a high level technology. If there is such a breakthrough it will appear in Hungary also, a few years later, just as it happened in the case of personal computers. F.M.R.

N86-16435# Joint Publications Research Service, Arlington, Va.
SILICON SEMICONDUCTOR DEVELOPMENTS **c76**
Andrzej Bukowski *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 38-39 Repr. from Polish Technical Review (Warsaw, Poland), no. 2-3, 1985 p 3-4 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

New techniques for the manufacture of silicon monocrystals have been developed at the Institute of Electronic Materials Technology (ITME), some of which are presented, i.e., silicon monocrystals with a diameter of 100 mm; silicon monocrystals with a diameter of 76 mm; silicon monocrystals doped with phosphorous by the neutron transmutation method (ND-Di); and silicon epitaxial layers. Author

N86-16436# Joint Publications Research Service, Arlington, Va.
ELECTROPLATING PROCESS EQUIPMENT PROFILED **c26**
Karol Patorski and Jerzy Strzelecki *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 40-42 Repr. from Polish Technical Review (Warsaw, Poland), no. 2-3, 1985 p 13-14 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

The design of the MINI automatic electroplating machines is the latest achievement of the ZUGiL Works in Wielun, Poland. These automatic electroplating machines are designed for the application of noble metal coatings on small-sized objects. The encapsulated switches to be electroplated using the program-controlled automatic electoplating machines are suspended from hangers or placed in drums or baskets and transferred automatically through all work stations, according to predetermined technological programs. The MINI automatic electroplating machines are designed and built on an individual (i.e., single-piece) basis, depending on the size of the objects to be electroplated, and on the required size, kind and thickness of the coating and on the electroplating technology employed. Author

N86-16437# Joint Publications Research Service, Arlington, Va.
COMPOSITE ELECTRIC CONTACT MATERIALS c33
Jacek Senkara and Jan Kowalczyk *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 48-49 Repr. from Polish Technical Review (Warsaw, Poland), no. 2-3, 1985 p 9-10 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

Two-phase composite materials, i.e., a high-melting component combined with a material exhibiting good electrical and thermal properties find a wide range of application for the manufacture of small- and medium-load relays and switches. Composite contacts can be used in air circuit-breakers (W-Ag, Ag-Ni), oil circuit-breakers (W-Cu, Mo-Cn), vacuum-type switches (W-CuSb, CuCr), and also switches operating in an atmosphere of SF sub 6 (W-Cu). Present-day trends aimed at increasing operating reliability and extending the service life of electrical equipment are finding their expression in efforts being made to modify the classical composites with a veiw to imparting new properties to them by suitably changing their composition and structure. These trends are also aimed at reducing the consumption of noble metals and of strategically important ones. Modern materials engineering and metallurgical technologies are being used, including isostatic sintering or explosive forming. Owing to the high activity of the constituents, all processes are conducted under high vacuum or in pure reducing atmospheres. Author

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-16438 Department of the Air Force, Washington, D.C.
MULTIPLEXED DATA STREAM MONITOR Patent
J. F. Gentry, inventor (to Air Force) Issued 9 Jul. 1985 9 p Supersedes AD-D010780
(AD-D011898; US-Patent-4,528,660; US-Patent-Appl-SN-559611; US-Patent-Class-370-80) Avail: US Patent and Trademark Office CSCL 17/2

A multiplexed data stream circuit is described which comprises a random memory stream which is transmitted together with a synchronization signal and a data clock. A counter circuit is reset by the synchronization signal and counts the data clock signals to accumulate counts uniquely identified accumulated count location is addressed in the random access memory to read the immediately preceding data state of the current signal and the immediately preceding data stream signal as read from the random access memory are compared by gating circuitry to identify characteristics of the data stream. State changes of the signals within the multiplexed data stream are identified if the gating circuitry comprises an EXCLUSIVE OR gate. Author (GRA)

N86-16439 Department of the Air Force, Washington, D.C.
RADIO FREQUENCY LENS ANTENNA Patent
R. E. Clapp, inventor (to Air Force) Issued 11 Jun. 1985 11 p Supersedes AD-D010416
(AD-D011906; US-Patent-4,523,198; US-Patent-Appl-SN-511697; US-Patent-Class-343-754) Avail: US Patent and Trademark Office CSCL 09/5

Multiple beam antennas are modified and improved through the use of lenses coupled together by hybrid junctions. A dual lens structure avoids circulators while permitting the lenses to be used both for transmission and for reception. A six lens structure provided perfect phase focusing utilizing an R-2R geometry with a Mobuis topology, giving 360 degrees of independent antenna beams from a single circular or cylindrical antenna array. Author (GRA)

N86-16440# University of Electro-Communications, Tokyo (Japan).
REPORTS OF THE UNIVERSITY OF ELECTRO-COMMUNICATIONS, VOLUME 36, NO. 1, SEPTEMBER 1985 (SERIAL NO. 58)
Sep. 1985 225 p refs In JAPANESE; ENGLISH summaries (ISSN-0493-4253) Avail: NTIS HC A10/MF A01

The reports of the University of Electro-Communications are divided into two sections: (1) Science and Technology and (2) Humanity and Social Science. Some articles from the first section are entitled: (1) lamp annealing of ion implanted GaAs; (2) two level quantization of grey level picture signals; (3) computer controlled preparation of several metal complexes; and (4) carbon dioxide in the atmosphere. Some titles from the second section are: (1) arabic science - Architecture and art; (2) the use of (E)th and (E)s in verb endings; and (3) notes on Johnson's Preface to Shakespeare. For individual titles, see N86-16441 through N86-16450.

N86-16441# University of Electro-Communications, Tokyo (Japan).
EXPERIMENTAL STUDY OF NARROW-BAND DIGITAL COMMUNICATION BY MEANS OF PREMODULATION LOW PASS FILTER
Tomohiko Ozaki, Koichi Usami, and Sonosuke Yamanaka *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 1-7 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

MSK (Minimum Shift Keying) is a very attractive modulation technique for the application of digital transmissions because of its relatively compact power spectrum and the constant envelope property. However, when MSK is applied to the digital mobiel radio communications, the adjacent channel interferences occur owing to the out of band radiation power. Therefore the narrower band digital modulation scheme is required. One of the method for narrowing the spectrum is to shape the modulating signals by LPF at the input of the MSK modulator. Some experimental results of MSK with Butterworth filter as the premodulation LPF is described. Author

N86-16442# University of Electro-Communications, Tokyo (Japan).
THE STUDY IN SUB E CLASS CONVERTER WITH SATURATING CORES c33
Toshimitsu Suzuki, Koichi Usami, and Sonosuke Yamanaka *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 9-13 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

Recently, for switching power supplies it is best to be smaller in size, with electronic equipments' miniaturization by IC technology. Sub E class dc-to-dc converter with a saturating core has the properties of high efficiency, small size, light weight and high reliability. Hence, the applications of switching regulater power supply to this technique are studied by many investigators. The results of an experiment in sub E class dc-to-dc converter with magnetic amplifier is presented. Author

N86-16443# University of Electro-Communications, Tokyo (Japan).
LAMP ANNEALING OF ION IMPLANTED GaAs **c76**
Haruzo Miyashita and Kotaro Okamoto *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 15-21 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

Halogen lamps are used to anneal Si implanted GaAs. SiO2/Al2O3 double layered capping is proved to be more effective than the conventional SiO2 capping. It also becomes apparent that optimal activation is established in shorter processing time for annealing of implanted side irradiation than for backside irradiation. Electron mobility of activated layers reflect the characteristics of the substrates and undoped LEC GaAs substrate shows highest mobility of 4,120 sq. cm./V.s. Author

N86-16444# University of Electro-Communications, Tokyo (Japan).
THE TWO LEVEL QUANTIZATION OF GRAY LEVEL PICTURE SIGNAL
Shuichi Itoh, Masahiro Ishii, Yasuo Fukamachi, and Ryuichi Saitoh *In its* Reports of the University of Electro-Communications, Volume 37, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 23-28 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

The methods for the quantization of gray level picture signal into two levels are discussed. With ordinary facsimile quantizer, input signal is applied to a comparator, where it is compared with a fixed threshold. But since this quantizer will hard limit the signal, the coding characteristics are very poor for half tone pictures and documents with tint background. Quantizers with fixed threshold, moving average threshold, dither threshold and their combinations were examined. Through simulations and experiments on actual facsimile equipment, it was determined that the combined system of moving average and dither threshold gives the best reproduction for photographic images of human face. Author

N86-16445# University of Electro-Communications, Tokyo (Japan). Dept. of Materials Science.
METHOD FOR PRECISELY COMPUTING MOLECULAR INTEGRALS OVER STOS WITH n=l **c72**
Noboru Suzuki *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 49-60 refs (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

Calculations of the relativistic effects in molecules by the use of the Dirac equation requires the evaluation of molecular integrals over atomic orbitals (AOs) with principal and azimuthal quantum numbers, n and l, of the same value. However, a method of precisely computing such molecular integrals has not yet been established. A method is given for precise evaluation of such diatomic molecular integrals by the use of Slater type orbitals (STOs) as AOs. Most types of those integrals can readily be evaluated by introducing an auxiliary integration function, -Ei(-alpha) where alpha is positive, into the established formulations able to calculate the diatomic molecular integrals over STOs with n>l. In evaluation of two electron two center Coulomb repulsion integrals, however, the division of the integration region into several parts is necessary because the charge density expressed by product of two n=l STOs centered at the same nucleus, varies very sharply near the nucleus. Author

N86-16446# University of Electro-Communications, Tokyo (Japan).
CARBON-14 NMR SPECTRUM (68 MHz) OF 2,6-DINITROPHENOL IN CDCl3 AND THE TEMPERATURE VARIATION OF THE CHEMICAL SHIFTS IN REFERENCE TO INTRAMOLECUAR HYDROGEN BOND **c25**
Ariyuki Aihara and Kazuhiro Matsushita *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 61-65 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

H-1 as well as Cl-13 NMR spectra, at 270 MHz and 68 MHz, respectively, were observed with 2,6-dinitrophenol and some related substances in order to get a further insight into the nature of intramolecular hydrogen bond formed therein. Temperature variation of the C-13 NMR signals of 2,6-dinitrophenol revealed an interesting feature in the chemical shifts of phenyl carbons which suggests a close relationship between chemical shift of carbons and pi-electron densities on the atoms being induced by formation and breakage of the intramolecular hydrogen bond. Author

N86-16447# University of Electro-Communications, Tokyo (Japan).
COMPUTER AS A MODEL AND COMPUTER AS A TOOL: CP/M-80 SIMULATOR ON VOS3/TSS **c61**
Kazumiti Numata and Yuichi Aida *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 67-74 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

The theme of the educational experiments were designed where two roles of computer are clearly separated. This theme, implementing the microprocessor and its operating system on large scale general purpose computer, was accepted with much interest and carried out under clear recognition of the object and means. The product completed by the additional works after regular course seems to suggest some possibility of this idea. The process of the work, the method of debugging and the problems come from the tool computer are reported. Author

N86-16448# University of Electro-Communications, Tokyo (Japan).
COMPUTER CONTROLLED PREPARATION OF SEVERAL METAL COMPLEXES-1 **c26**
Nobuhide Kokubu, Akira Yamasaki, Hiroya Shiraki, Hiroshi Togashi, Masaki Yasumoto, and Yasuhiro Yamanaka *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 81-85 In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

The simple computer controlled metal complex precipitation and filtration system was constructed simulating the usual laboratory experimental procedure, and practically applied to prepare several familar metal complexes in laboratory scale. The examined complexes are: (1) hexaammminecobalt(III), (2) aquapentammineco-balt(III) and (3) tetraamminecopper(II) complexes. Both tervalent cobalt (III) complexes were precipitated with aqueous potassium hexacyanoferrate(III). Tetraamminecopper(II) sulfate was precipitated by adding excess ethyl alcohol. Author

N86-16449# University of Electro-Communications, Tokyo (Japan).
CARBON DIOXIDE IN THE ATMOSPHERE **c45**
Nobuhide Kokubu, Sigeru Kumagai, and Akira Miyazaki *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 87-91 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

The results of airborne carbon dioxide determinations made from October 1969 to January 1970 around Tyohu city of Tokyo are reported. Carbon dioxide content was 340 to 510 ppm at Tyohu city, and 360 to 530 ppm at the heavy traffic road. Carbon dioxide content at the suburbs of Tokyo was 370 to 430 ppm. The results are mainly affected by human activities. The weather conditions also affect carbon dioxide content. Author

N86-16450# University of Electro-Communications, Nagano (Japan). Sugadaira Space Radiowave Observatory.
PHASE FLUCTUATION MEASUREMENT WITH HF-BAND VLBI SYSTEM AND ITS APPLICATION TO OBSERVATION OF JUPITER'S DECAMETRIC EMISSIONS
Ichiro Tomizawa *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 99-112 refs (For primary document see N86-16440 07-32)

Avail: NTIS HC A10/MF A01

The phase fluctuation of the HF-band VLBI system is measured by a simulation method, using a new type of phase processing in which the frequency range of phase fluctuation spectrum is expanded. The phase fluctuation of the VLBI system gives a certain threshold from which one can detect the source movement and the spectrum of phase fluctation originated from the density fluctuation of interplanetary plasma. It is concluded that the long duration and even low speed movement of source can be detected, and that the phase fluctuation spectrum can be also estimated by the present VLBI system as long as the input signal-to-noise ratio is greater than 10 dB. Author

N86-16451*# Princeton Synergetics, Inc., N.J.

EVALUATION OF SPACECRAFT TECHNOLOGY PROGRAMS (EFFECTS ON COMMUNICATION SATELLITE BUSINESS VENTURES), VOLUME 1 Final Report

Joel S. Greenburg, Carole Gaelick, Marshall Kaplan (Spacetech, Inc.), Janis Fishman, and Charles Hopkins (Econ, Inc., San Jose, Calif.) Sep. 1985 136 p refs 2 Vol.

(Contract NAS3-23886)

(NASA-CR-174978; NAS 1.26:174978) Avail: NTIS HC A09/MF A01 CSCL 17B

Commercial organizations as well as government agencies invest in spacecraft (S/C) technology programs that are aimed at increasing the performance of communications satellites. The value of these programs must be measured in terms of their impacts on the financial performane of the business ventures that may ultimately utilize the communications satellites. An economic evaluation and planning capability was developed and used to assess the impact of NASA on-orbit propulsion and space power programs on typical fixed satellite service (FSS) and direct broadcast service (DBS) communications satellite business ventures. Typical FSS and DBS spin and three-axis stabilized spacecraft were configured in the absence of NASA technology programs. These spacecraft were reconfigured taking into account the anticipated results of NASA specified on-orbit propulsion and space power programs. In general, the NASA technology programs resulted in spacecraft with increased capability. The developed methodology for assessing the value of spacecraft technology programs in terms of their impact on the financial performance of communication satellite business ventures is described. Results of the assessment of NASA specified on-orbit propulsion and space power technology programs are presented for typical FSS and DBS business ventures. R.J.F.

N86-16452*# Princeton Synergetics, Inc., N.J.

EVALUATION OF SPACECRAFT TECHNOLOGY PROGRAMS (EFFECTS ON COMMUNICATION SATELLITE BUSINESS VENTURES), VOLUME 2 Final Report

Joel S. Greenburg, Marshall Kaplan (Spacetech, Inc.), Janis Fishman, and Charles Hopkins (Econ, Inc., San Jose, Calif.) Sep. 1985 155 p 2 Vol.

(Contract NAS3-23886)

(NASA-CR-174979; NAS 1.26:174979) Avail: NTIS HC A08/MF A01 CSCL 17B

The computational procedures used in the evaluation of spacecraft technology programs that impact upon commercial communication satellite operations are discussed. Computer programs and data bases are described. R.J.F.

N86-16453*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.

ERROR CONTROL TECHNIQUES FOR SATELLITE AND SPACE COMMUNICATIONS Semiannual Status Report, 1 Jun. 1985 - 31 May 1986

Daniel J. Costello, Jr. Jan. 1986 22 p refs

(Grant NAG5-557)

(NASA-CR-176568; NAS 1.26:176568) Avail: NTIS HC A02/MF A01 CSCL 17B

The performance anlaysis of NASA's telecommand systems was summarized. It is assumed that the decoded frames are scrambled prior to decoding by the outer code. The average decoded bit error rate are examined which allows the possibility of evaluating many different frame coding options. The capacity and cutoff rate of the outer channel formed by the combination of the actual physical channel and the inner encoder and decoder in a concatenated coding system were analyzed. The best combination of inner and outer codes to use in a concatenated coding system were determined. It was established that in general: (1) it is better not to interleave between the inner and outer codes; and (2) for a fixed overall code rate, it is better to use higher rate inner codes and lower rate outer codes. Inner convolutional codes are considered. The analysis is more difficult in this case because the inner decoder error events do not appear in blocks of fixed length but can be of many different lengths. Author

N86-16454*# Illinois Inst. of Tech., Chicago. Dept. of Electrical Engineering.

RELIABILITY AND THROUGHPUT ANALYSIS OF A CONCATENATED CODING SCHEME

Robert H. Deng and Daniel J. Costello, Jr. (Notre Dame Univ., Ind.) [1985] 35 p refs

(Grants NAG5-234; NAG5-557)

(NASA-CR-176570; NAS 1.26:176570) Avail: NTIS HC A03/MF A01 CSCL 17B

The performance of a concatenated coding scheme for error control in ARQ systems is analyzed for both random-noise and burst-noise channels. In particular, the probability of undetected error and the system throughput are calculated. In this scheme, the inner code is used for both error correction and error detection, and the outer code is used for error detection only. Interleaving/deinterleaving is assumed within the outer code. A retransmission is requested if either the inner code or the outer code detects the presence of errors. Various coding examples are considered. The results show that concatenated coding can provide extremely high system reliability (i.e., low probability of undetected error) and high system throughput. Author

N86-16455*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

TOPOLOGY DESIGN AND PERFORMANCE ANALYSIS OF AN INTEGRATED COMMUNICATION NETWORK

Victor O. K. Li, Y. F. Lam, T. C. Hou, and Joseph H. Yuen 15 Sep. 1985 50 p refs Prepared in cooperation with Univ. of Southern California, Pasadena

(Contract NAS7-918)

(NASA-CR-176447; JPL-Pub-85-67; NAS 1.26:176447) Avail: NTIS HC A03/MF A01 CSCL 17B

A research study on the topology design and performance analysis for the Space Station Information System (SSIS) network is conducted. It is begun with a survey of existing research efforts in network topology design. Then a new approach for topology design is presented. It uses an efficient algorithm to generate candidate network designs (consisting of subsets of the set of all network components) in increasing order of their total costs, and checks each design to see if it forms an acceptable network. This technique gives the true cost-optimal network, and is particularly useful when the network has many constraints and not too many components. The algorithm for generating subsets is described in detail, and various aspects of the overall design procedure are discussed. Two more efficient versions of this algorithm (applicable in specific situations) are also given. Next, two important aspects of network performance analysis: network reliability and message delays are discussed. A new model is introduced to study the reliability of a network with dependent failures. For message delays, a collection of formulas from existing research results is given to compute or estimate the delays of messages in a communication network without making the independence assumption. The design algorithm coded in PASCAL is included as an appendix. Author

N86-16456*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CONSIDERATION OF RADAR TARGET GLINT FROM ST DURING OMV RENDEZVOUS

Malcolm W. McDonald, Lee B. Malone, and Edmund H. Gleason Sep. 1985 13 p refs
(NASA-TM-86533; NAS 1.15:86533) Avail: NTIS HC A02/MF A01 CSCL 17I

The nature of radar target glint and the factors upon which it depends when using the Hubble Space Telescope as a radar target is discussed. An analysis of the glint problem using a 35 MHz or 94 MHz radar on the orbital maneuvering vehicle is explored. A strategy for overcoming glint is suggested. Author

N86-16457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MONOLITHIC OPTICAL INTEGRATED CONTROL CIRCUITRY FOR GaAs MMIC-BASED PHASED ARRAYS
K. B. Bhasin, G. E. Ponchak, and T. J. Kascak 1985 17 p refs Presented at the Symposium on Optical and Electro-Optical Engineering, Cambridge, Mass., 15-20 Sep. 1985; sponsored by the Society for Photo-Instrumentation Engineering
(NASA-TM-87183; E-2835; NAS 1.15:87183) Avail: NTIS HC A02/MF A01 CSCL 09C

Gallium arsenide (GaAs) monolithic microwave integrated circuits (MMIC's) show promise in phased-array antenna applications for future space communications systems. Their efficient usage will depend on the control of amplitude and phase signals for each MMIC element in the phased array and in the low-loss radiofrequency feed. For a phased array contining several MMIC elements a complex system is required to control and feed each element. The characteristics of GaAs MMIC's for 20/30-GHz phased-array systems are discussed. The optical/MMIC interface and the desired characteristics of optical integrated circuits (OIC's) for such an interface are described. Anticipated fabrication considerations for eventual full monolithic integration of optical integrated circuits with MMIC's on a GaAs substrate are presented. E.A.K.

N86-16458*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL TECHNIQUES TO FEED AND CONTROL GaAs MMIC MODULES FOR PHASED ARRAY ANTENNA APPLICATIONS
K. B. Bhasin, G. Anzic, R. R. Kunath, and D. J. Connolly 1986 13 p refs Proposed for presentation at the 11th Communications Satellite Systems Conference, San Diego, Calif., 16-20 Mar. 1986; sponsored by AIAA
(NASA-TM-87218; E-2880; NAS 1.15:87218) Avail: NTIS HC A02/MF A01 CSCL 20N

A complex signal distribution system is required to feed and control GaAs monolithic microwave integrated circuits (MMICs) for phased array antenna applications above 20 GHz. Each MMIC module will require one or more RF lines, one or more bias voltage lines, and digital lines to provide a minimum of 10 bits of combined phase and gain control information. In a closely spaced array, the routing of these multiple lines presents difficult topology problems as well as a high probability of signal interference. To overcome GaAs MMIC phased array signal distribution problems optical fibers interconnected to monolithically integrated optical components with GaAs MMIC array elements are proposed as a solution. System architecture considerations using optical fibers are described. The analog and digital optical links to respectively feed and control MMIC elements are analyzed. It is concluded that a fiber optic network will reduce weight and complexity, and increase reliability and performance, but higher power will be required. Author

N86-16459*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A STUDY OF THE EFFECTS OF INTERFERENCE-REJECTION FILTERS ON FEEDBACK RADIOMETER SENSITIVITY
William D. Stanley (Old Dominion Univ., Norfolk, Va.) and Chase P. Hearn Dec. 1985 95 p
(NASA-TM-87651; NAS 1.15:87651) Avail: NTIS HC A05/MF A01 CSCL 14B

The trade-offs between sensitivity and interference immunity resulting from input bandpass filter losses in a noise-injection feedback radiometer are examined. Data are provided to permit the selection of an optimum filter configuration based on the independent variables of percentage bandwidth, q-factors, and desired band-edge rejection. E.A.K.

N86-16460*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANGULAR POWER SPECTRUMS AND THEIR RELATIONSHIP TO AUTOCORRELATION FUNCTIONS OF APERTURE ANTENNAS
C. R. Cockrell Oct. 1985 13 p refs
(NASA-TM-87630; NAS 1.15:87630) Avail: NTIS HC A02/MF A01 CSCL 20N

Normalized angular power spectrum representations have been derived for linear and circular aperture antennas in terms of their autocorrelation functions. Examples of their use are given. Author

N86-16461*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPENSATION OF REFLECTOR SURFACE DISTORTIONS USING CONJUGATE FIELD MATCHING
Roberto J. Acosta 1986 9 p refs Proposed for presentation at the International IEEE A/P-S Symposium and National Radio Science Meeting, Philadelphia, Pa., 9-13 Jun. 1986
(NASA-TM-87198; E-2852; NAS 1.15:87198) Avail: NTIS HC A02/MF A01 CSCL 20N

The feasibility of compensating for reflector surface distortions has been investigated. The performance characteristics (gain, sidelobe level, null location, beamwidth, etc.) of space communication reflector antenna systems degrade as the reflector surface distorts due to thermal effects from a varying solar flux. The technique reported here will maintain the design radiation performance independently of thermal effects on the reflector surface. With the advent of monolithic microwave integrated circuits (MMIC), a greater flexibility in array-fed reflector system design can be achieved. MMIC arrays provides independent control of amplitude and phase for each of many radiating elements of the feed array. The conjugate field matching technique provide a basis for obtaining the required element excitations under surface distortion for maintaining the design radiation performance. It is assumed that the surface characteristics (x, y, z, first derivatives, and second derivatives) under distortion are known. Author

N86-16462# Selenia S.p.A., Rome (Italy).
RIVISTA TECNICA SELENIA, VOLUME 9, NUMBER 2, 1985
Adriana Marzi, ed. 1985 43 p refs
Avail: NTIS HC A03/MF A01

The design of microwave ferrite devices; synthesis and evaluation of phase codes for pulse compression radar; the combined effect of infant mortality and installation plan on mean time between failure, and a rapid commutation duplexer with phase-related outputs are discussed. For individual titles, see N86-16463 through N86-16466.

N86-16463# Selenia S.p.A., Rome (Italy). Research Dept.
AN INTRODUCTION TO THE DESIGN OF MICROWAVE FERRITE DEVICES **c33**
Riccardo Roveda, Carlo diGregorio, and Nicola Scafuro *In its* Rivista Tecnica Selenia, Vol. 9, No. 2, 1985 1985 p 1-11 refs (For primary document see N86-16462 07-32)
Avail: NTIS HC A03/MF A01

The properties of ferrimagnetic materials and their relationships with operation and performance of ferrite microwave devices are introduced. Susceptibility; dissipative magnet parameters; reactive magnet parameters; dielectric characteristics; circulators; phase shifters; filters; limiters; and isolators are discussed. Author (ESA)

N86-16464# Selenia S.p.A., Rome (Italy). Radar Dept.
SYNTHESIS AND EVALUATION OF PHASE CODES FOR PULSE COMPRESSION RADAR
Antonio Divito, Alfonso Farina, Gennaro Fedele, Gaspare Galati, and Flavio A. Studer *In its* Rivista Tecnica Selenia, Vol. 9, No. 2, 1985 1985 p 12-24 refs (For primary document see N86-16462

07-32)
Avail: NTIS HC A03/MF A01

The synthesis of pulse compression radar signals is examined. A family of waveforms suitable for digital compression is identified in digital (or discrete) chirp. Such a code, obtained through sampling and quantization of known chirp waveforms, has attractive features such as relative insentitivity to frequency shift and low sidelobes. Within the digital pulse compression technique, with compression ratio higher than a few tens, digital chirp codes perform better than other codes. Author (ESA)

N86-16465# Selenia S.p.A., Rome (Italy).
THE COMBINED EFFECT OF INFANT MORTALITY AND INSTALLATION PLAN ON MEAN TIME BETWEEN FAILURE c38
Giuseppe Rosato and Lamberto Pescatori *In its* Rivista Tecnica Selenia, Vol. 9, No. 2, 1985 1985 p 25-33 (For primary document see N86-16462 07-32)
Avail: NTIS HC A03/MF A01

Models used during the dimensioning of the logistics support for supervisory systems, in particular in the TUT computer based supervisory and control system are illustrated. The combined effects of reliability growth and of the installation plan are analyzed. A model to determine the multiplicative factor of the steady state average failure rate in specified operating conditions is assessed. Author (ESA)

N86-16466# Selenia S.p.A., Rome (Italy). Research Dept.
RAPID COMMUTATION DUPLEXER WITH PHASE-RELATED OUTPUTS
Riccardo Roveda, Giuseppe Cattarin, Carlo diGregorio, and Umberto Parrucci *In its* Rivista Tecnica Selenia, Vol. 9, No. 2, 1985 1985 p 34-39 refs (For primary document see N86-16462 07-32)
Avail: NTIS HC A03/MF A01

Design criteria and the realization of an X-band waveguide rapid commutation duplexer, in production, are presented. By means of a digital TTL command it is capable of operating in three different conditions: all the power is conveyed to a single output; the poweer is equally divided between two in-phase outputs; and it is equally divided between two counter-phase outputs. In a monopulse radar this permits the electronic scanning of the antenna beam. Author (ESA)

N86-16467# Delta Information Systems, Inc., Horsham, Pa.
TEST AND EVALUATION OF VIDEO TELECONFERENCING AT 56 KBPS Final Report
Mar. 1985 128 p
(Contract DCA100-83-C-0047)
(AD-A156760; NCS-TIB-85-3) Avail: NTIS HC A07/MF A01 CSCL 17/2

The National Communications System is actively working with the CCITT and ANSI Standards organizations toward the establishment of a standard for video teleconferencing at ISDN communication rates below 1.544 Mbps (e.g. 384 kbps, 64 kbps, 56 kpbs), the 56 kpbs data race is of particular importance because AT&T has announced a circuit-switched data network operating at this rate which will use the public switched telephone network. The ubiguitous network will provide an excellent resource for future teleconferencing applications. Concurrent with the evolution of the switched 56 kbps data network. Although the animation distortion of these codes is more severe than the 1.544 Mbps codecs, it is likely that the image quality will be acceptable for many teleconference applications. The purpose of this project is to determine the acceptability of the video teleconference image quality when operating at 56 kbps. This was accomplished by installing a video teleconference system in an operational environment and evaluating the acceptability of the service. GRA

N86-16468# Rome Air Development Center, Griffiss AFB, N.Y.
SIDELOBE SECTOR NULLING WITH MINIMIZED PHASE PERTURBATIONS Report, Sep. 1984 - Jan. 1985
R. A. Shore and D. A. Pierre 10 Oct. 1985 22 p Sponsored by AF
(AD-A157058; RADC-TR-85-56) Avail: NTIS HC A02/MF A01 CSCL 09/5

A new phase-only pattern synthesis method was developed to lower the sidelobes of a given antenna pattern in a wide sector, while reducing pattern distortion elsewhere. The method consists of finding the phase perturbations that minimize a performance measure defined to be a weight sum of the average sector sidelobe power and the sum of squared weight perturbations. By varying the weights in the performance measure assigned to the sidelobe sector power and the weight perturbations, it is possible to shift the relative emphasis placed on the two objectives of reduced sidelobe power and small pattern distortion. The phase perturbations are obtained numerically using a nonlinear computer optimization code, since the equations obtained by equating to zero the partial derivatives are nonlinear and cannot be solved analytically. Curves are plotted showing the variation of the average sector sidelobe power, sum of the squared weight perturbations, gain in the look direction, and pattern null locations, with the ratio of the weights in the performance measure. Examples are shown of the patterns with reduced sidelobes that are obtained using this method. Author (GRA)

N86-16469# Naval Ocean Systems Center, San Diego, Calif.
THEORY AND CALCULATION FOR THE EFFECT OF A HOMOGENEOUS, CYLINDRICALLY SYMMETRIC DISTURBANCE ON ELF (EXTREMELY LOW FREQUENCY) PROPAGATION Research Report, Dec. 1984 - Jul. 1985
R. A. Pappert Jul. 1985 72 p
(99Q-MXBB)
(AD-A159348; NOSC/TR-1043) Avail: NTIS HC A04/MF A01 CSCL 20/14

A simple surface propagation model is commonly used to estimate the effects of ionospheric disturbances on extremely low frequency (ELF) propagation, Though often adequate, one shortcoming of the model is its failure to allow for excitation by the broad-side component of a horizontal dipole. That excitation can be quite significant in a sporadic-E environment, when the modal polarization can contain a substantial mixture of TE component. In this study a beginning is made on ELF propagation model development which allows for broadside excitation as well as a systematic allowance for height gain effects. The development is for a flat earth with a laterally homogeneous, cylindrically symmetric disturbance centered over the transmitter. The method utilizes normal-mode decomposition. Matching equations at the boundary of the disturbance are developed by evaluating height gain integrals, and it is shown that this method is tantamount to simply matching the ground vertical electric and azimuthal magnetic fields at the boundary. Results for a sporadic-E type environment indicate substantial departures from the surface propagation model and WKB predictions. GRA

N86-16470# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF COHERENT DIGITAL RECEIVERS THE PRESENCE OF COLORED NOISE INTERFERENCE M.S. Thesis
A. Hasarchi Jun. 1985 142 p
(AD-A159373) Avail: NTIS HC A07/MF A01 CSCL 09/4

Optimum receivers for detecting binary signals in additive colored Gaussian noise are analyzed and their performance evaluated in terms of bit error probabilities (Pe). Implementation and practical design implications of such receivers is discussed. Evaluation of Pe receivers that are optimum for additive white Gaussian noise (WGN) environments but due to jamming or friendly ECM interferers, must operate in a colored Gaussian noise environment has been carried out. It was generally found that such receivers do not perform significantly worse than receivers specifically designed to operate in a colored noise environment. Examples were considered in which the colored noise interference was modeled as the output of a one-pole filter driven by WGN. Additional work has been carried out on the jamming of binary (colored noise) receivers using a deterministic jammer model. While this modeling assumption needs to be refined, it has been demonstrated that a power constrained jammer can seriously

degrade the performance of a receiver designed to operate in a colored noise environment. Author (GRA)

N86-16471# Department of Energy, Washington, D. C.
PULSE-EXCITED, AUTO-ZEROING MULTIPLE CHANNEL DATA TRANSMISSION SYSTEM Patent Application
G. E. Fasching, inventor (to DOE) Filed 22 Feb. 1985 17 p
(DE85-017760; US-Patent-Appl-SN-704114) Avail: NTIS HC A02/MF A01

A multiple channel data transmission system is provided in which signals from a plurality of pulse operated transducers and a corresponding plurality of pulse operated signal processor channels are multiplexed for single channel FM transmission to a receiving station. The transducers and corresponding channel amplifiers are powered by pulsing the dc battery power to these devices to conserve energy and battery size for long-term data transmission from remote or inaccessible locations. Auto zeroing of the signal channel amplifiers to compensate for drift associated with temperature changes, battery decay, component aging, etc., in each channel is accomplished by means of a unique auto zero feature which between signal pulses holds a zero correction voltage on an integrating capacitor coupled to the corresponding channel amplifier output. Pseudo-continuous outputs for each channel are achieved by pulsed sample-and-hold circuits which are updated at the pulsed operation rate. The sample-and-hold outputs are multiplexed into an FM/FM transmitter for transmission to an FM receiver station for demultiplexing and storage in separate channel recorders. DOE

N86-16472# Brookhaven National Lab., Upton, N. Y.
NEW METHOD FOR PUMPING AN OPTICAL KLYSTRON
G. Vignola, R. R. Freemen, B. M. Kincaid, C. Pellegrini, A. Luccio, J. Murphy, J. Galayda, and A. VanSteenbergen 1985 14 p Presented at the Workshop on Coherent and Collective Propagation of Relativistic E-Beams and Electromagnetic Radiation, Villa Olmo, Italy, 13 Sep. 1984 Prepared in cooperation with Bell Telephone Labs., Murray Hill, N.J.
(Contract DE-AC02-76CH-00016)
(DE85-014821; BNL-36677; CONF-8409163-6) Avail: NTIS HC A02/MF A01

A novel method of operation for a transverse optical klystron (TIK) is proposed. The TOK is a device in which a relativistic electron beam produces tunable coherent radiation at short wavelengths by interacting with a powerful external laser and an undulator field. Here it is shown that by selecting the external laser wavelengths to be one of the harmonics in the undulator radiation spectrum, excellent output at short wavelength can be realized with significantly reduced performance requirements for the undulator magnet and the storage ring providing the electron beam. DOE

N86-16473# Lawrence Livermore National Lab., Calif.
ELF-VLF COMMUNICATIONS THROUGH-THE-EARTH Project Report, for calendar year 1984
H. M. Buettner, G. J. Burke, E. M. Didwall, G. Holladay, and R. J. Lytle Jun. 1985 89 p
(Contract W-7405-eng-48)
(DE85-015417; UCID-20473) Avail: NTIS HC A05/MF A01

We use computer models and experiments to explore the feasibility of communication between points underground and on the Earth's surface. Emphasis is placed on ELF-VLF electromagnetic propagation through the Earth; nominally, we investigated propagation in the 200 Hz-30 kHz frequency range. The computer modeling included calculations of the fields of a point electric or magnetic source in a homogeneous half space or a stratified Earth. Initial results for an insulated antenna of finite length are also considered. The experiments involved through-the-Earth transmissions at two locations in Pennsylvania, both of which had large formations of limestone. Initial results indicate that information rates as high as kbits/s may be possible for subsurface depths of 300 m or less. Accuracy of these estimated depends on the electromagnetic propagation constants of the rock, the noise characteristics, and modulation scheme. Although a nuisance for evaluating through-the-Earth propagation, the existence of subsurface metal conductors can improve the transmission character of the site. DOE

N86-16474# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Systems Technology Div.
NUCLEAR ELECTROMAGNETIC PULSE AND THE ELECTRIC POWER SYSTEM
J. R. Legro and T. J. Reed 1985 27 p Presented at the Electrical Utility Engineering Conference, Pittsburgh, 12 May 1985
(Contract DE-AC05-84OR-21400)
(DE85-013600; CONF-8505173-1) Avail: NTIS HC A03/MF A01

A single, high-altitude nuclear detonation over the continental United States can expose large geographic areas to transient, electromagnetic pulse (EMP). The initial electromagnetic fields produced by this event have been defined as high-altitude electromagnetic pulse (HEMP). Later-time, low frequency fields have been defined as magnetohydrodynamic-electromagnetic pulse (MHD-EMP). Nuclear detonations at, or near the surface of the earth can also produce transient EMP. These electromagnetic phenomena have been defined as source region electromagnetic pulse (SREMP). The Division of Electric Energy Systems (EES) of the United States Department of Energy (DOE) has formulated and implemented a program Plan to assess the possible effects of the above nuclear EMP on civilian electric power systems. This unclassified research effort is under the technical leadership of the Oak Ridge National Laboratory. A brief perspective of EMP phenomenology and important interaction issues for power systems based on research performed by Westinghouse Advanced Systems Technology is given. DOE

N86-16475# Oak Ridge National Lab., Tenn.
SIMPLIFIED SOLUTIONS FOR PROBLEMS OF EMP-INDUCED CURRENTS IN BURIED CABLES
D. C. Agouridis and M. E. Buchanan 1985 5 p Presented at the Heart Conference, Monterey, Calif., 25 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016318; CONF-850756-3) Avail: NTIS HC A02/MF A01

The time waveform of currents, induced by EMP in buried cables, is determined numerically using a Fast Fourier Transform algorithm. The results are displayed graphically as a function of the electromagnetic properties of the ground and the distance of the cable below the surface. The solution is obtained by a procedure using graphs and simple calculations. DOE

N86-16476# Oak Ridge National Lab., Tenn.
SIMPLIFIED SOLUTION OF THE PROBLEM OF ELECTROMAGNETIC COUPLING TO TRANSMISSION LINES
D. C. Agouridis 1985 5 p Presented at the 22nd Annual Conference on Nuclear and Space Radiation Effects, Monterey, Calif., 22 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016319; CONF-850711-14) Avail: NTIS HC A02/MF A01

Electromagnetic waves induce distributed series voltage sources and shunt current sources in transmission lines. A solution of the response of the line driven by such sources is presented. This solution and the results are easy to understand and simple to use. The new solution has been applied to electromagnetic pulse (EMP) coupling problems. DOE

N86-16477# Department of Energy, Washington, D. C.
PHASE COMPARATOR APPARATUS AND METHOD Patent Application
F. E. Coffield, inventor (to DOE) Filed 1 Feb. 1985 24 p
(Contract W-7405-eng-48)
(DE85-017791; US-Patent-Appl-SN-697296) Avail: NTIS HC A02/MF A01

This invention finds especially useful application for interferometer measurements made in plasma fusion devices (e.g., for measuring the line integral of electron density in the plasma). Such interferometers typically use very high intermediate frequencies (e.g., on the order of 10 to 70 MHz) and therefore the phase comparison circuitry should be a high speed circuit with a linear

transfer characteristic so as to accurately differentiate between small fractions of interference fringes. DOE

N86-16478# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
NONSTATIONARY SIGNAL MODELING WITH APPLICATION TO BAT ECHO LOCATION
Yves Grenier Mar. 1985 37 p refs Presented at CNRS Colloquim on Systemes Sonar Aeriens Animaux, Lyon, 25 Feb.-1 Mar. 1985 Submitted for publication Sponsored in part by CNRS
(ENST-85C003; ISSN-0751-1337) Avail: NTIS HC A03/MF A01

Two classes of parametric estimators for the relief of a nonstationary signal were tested in an application to the analysis of bat echo location calls. The first class consists of autoregressive adaptive models. The second is characterized by the prior assumption of a time-variation of the model coefficient restricted to the space spanned by a known set of functions. These evolutionary models are split into autoregressive models, lattice filters, and log area models. Application of the models to three typical bat echo location calls shows the great accuracy of both classes. Author (ESA)

N86-16479# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
ELIMINATION OF RADAR NOISE AND SEQUENTIAL TARGET DETECTION: AN APPROACH TO PATTERN RECOGNITION AND ARRAY FILTERING Ph.D. Thesis [ELIMINATION DE FOUILLIS EN RADAR ET DETECTION SEQUENTIELLE DES CIBLES: UNE APPROCHE PAR LA RECONNAISSANCE DES FORMES ET LE FILTRAGE EN TREILLIS]
Jean-Francois Agnel 15 Mar. 1985 311 p refs In FRENCH
(ENST-85E003; ISSN-0751-1353) Avail: NTIS HC A14/MF A01

An adaptive sequential filter to eliminate background signatures in radar was studied. An autoregressive model of ground reflections is used to determine a compensating filter. Two models are studied. A global model includes learning of ground reflection data and real time recognition. The autoregressive model defines several representation spaces of the signal and leads to a parameter recognition of image patterns. The global model must be completed by adaptive sequential algorithms, resulting in simple tests showing environment changes or a target. The method presents a higher cost in data processing but is more efficient.
Author (ESA)

N86-16480# Ecole Nationale Superieure des Telecommunications, Paris (France). Laboratoire d'Electronique et de Physique Appliquee.
STUDY OF A TELEVISION SIGNAL COMPRESSION SYSTEM Ph.D. Thesis [ETUDE D'UNE CHAINE DE COMPRESSION D'IMAGES DE TELEVISION]
Mohammad-Reza Haghiri 28 Jan. 1985 314 p refs In FRENCH
(ENST-85E004; ISSN-0751-1353) Avail: NTIS HC A14/MF A01

Techniques to increase television signal compression ratio are studied. A first order Gauss-Markov model is used to compute the spectrum of the composite signal. Signal sampling at a frequency lower than the sum of that of the subcarriers causes a deficiency in the higher frequency region of the luminance component comparable to a crosscolor effect. To obtain a rate reduction of up to 10 times, the coding techniques included orthogonal transformations. The introduction of adaptive methods permits a further reduction of coding flow. The result is a signal rate of 20 Mbits/sec for the whole video signal without loss of broadcasting quality. Author (ESA)

N86-16481# Uppsala Ionospheric Observatory (Sweden).
MEASUREMENTS OF HF BACKSCATTER CROSS SECTION FOR STRIATIONS CREATED BY IONOSPHERIC HEATING AT DIFFERENT POWER LEVELS
A. Hedberg, H. Derblom, G. Hamberg, B. Thide, H. Kopka, and P. Stubbe (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) Apr. 1985 23 p refs Submitted for publication Sponsored by Deutsche Forschungsgemeinschaft and Swedish Natural Science Research Council
(UIO-SR-85-02) Avail: NTIS HC A02/MF A01

Ionospheric field-aligned irregularities induced by a heating facility were studied by HF backscatter radar. A power law relation between the received echo power and the stepwise changed heater power with an exponent varying between 1.5 and 1.9 is found. The radar cross section at 14 MHz is on the order of 35 to 55 dBsm, and a maximum volume cross section 0.00000036/m. Recording sequences for three different environmental ionospheric conditions are discussed. During favorable conditions backscatter echoes are observed at the lowest heater ERP of 14 MW. The cross section then saturates at 98 MW ERP and exhibits a pronounced decrease at higher heater ERP. During less favorable conditions the saturation level is not reached even at full power of 280 MW ERP. A correlation seems to exist between variations in the derived Hall current and the variation in cross section of the heater-induced field-aligned irregularities. Author (ESA)

N86-16482# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
AN ANALYTICAL MODEL FOR THE EVAPORATION DUCT, AND APPLICATION TO RADAR [EEN ANALYTISCH MODEL VOOR DE EVAPORATIE-DUCT EN DE TOEPASSING VOOR RADAR]
P. N. C. Nooy 7 Oct. 1983 192 p refs In DUTCH
Avail: NTIS HC A09/MF A01

An analytical model describing the evaporation-duct refraction of radar waves was developed. In order to make the model applicable to determine the radar range under duct conditions, the radar pattern function was synthesized using elementary point sources. It is shown that the exponential evaporation duct and the pattern synthesis provide a usable and fast procedure to predict radar performance in an evaporation duct. The range performance for a given antenna height depends strongly on target height. The range performance depends strongly on antenna height.
Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-16483 Department of the Air Force, Washington, D.C.
HIGH VOLTAGE GROUNDING DEVICE FOR PRESSURIZED EQUIPMENT Patent
J. W. Ogland, inventor (to Air Force) Issued 4 Jun. 1985 6 p Supersedes AD-D010774
(AD-D011901; US-Patent-4,521,656; US-Patent-Appl-SN-549532; US-Patent-Class-200-148B) Avail: US Patent and Trademark Office CSCL 09/5

A safety device is described for discharging high voltage circuits operated in pressurized containers. The device is positioned in pressurized containers. The device is positioned within an elbow or other protrusion through which passes the high voltage feed-through electrode. In one embodiment the grounding contact is automatically forced against the high voltage contact by the expansion of a bellows upon decompression of the container while in an alternate embodiment, the grounding contact is manually threaded against the high voltage contact. Author (GRA)

N86-16484 Department of the Air Force, Washington, D.C.
CLOCK DISTRIBUTION CIRCUIT FOR ACTIVE APERTURE ANTENNA ARRAY Patent
B. M. Bellman, inventor (to Air Force) Issued 4 Jun. 1985 6 p Supersedes AD-D010287
(AD-D011903; US-Patent-4,521,893; US-Patent-Appl-SN-487340; US-Patent-Class-375-107) Avail: US Patent and Trademark Office CSCL 17/2

A system is described for communicating a time reference or clock signal to a plurality of processors over substantial distances where propagation time between units is significant compared to the processing time. The timing signal is in the form of two continuous sinusoidal waves of different frequency but equal amplitude, which are added to give equal contributions in the resultant composite, two frequency, sum signal. The resulting waveform has sharply defined nulls occurring at the difference which are used as a precise time reference. Author (GRA)

N86-16485 Department of the Air Force, Washington, D.C.
SWITCH DEBOUNCE CIRCUIT Patent
F. A. Norris and D. J. Krile, inventors (to Air Force) Issued 11 Jun. 1985 5 p Supersedes AD-D010134
(AD-D011905; US-Patent-4,523,104; US-Patent-Appl-SN-468629; US-Patent-Class-307-207A) Avail: US Patent and Trademark Office CSCL 09/5

A circuit is described for eliminating transient pulses generated by bouncing mechanical contacts within a switch. A shift register accepts a series of binary input signals from the switch and propagates the signal out the register in parallel to a logic device for generating a resultant binary signal corresponding to the switch's debounced signal state. Author (GRA)

N86-16486*# ALPHATECH, Inc., Burlington, Mass.
ROBUST DETECTION-ISOLATION-ACCOMMODATION FOR SENSOR FAILURES Final Report
Jerold L. Weiss, Krishna R. Pattipati, Alan S. Willsky, John S. Eterno, and John T. Crawford Sep. 1985 220 p refs
(Contract NAS3-24078)
(NASA-CR-174797; NAS 1.26:174797; TR-213-1) Avail: NTIS HC A10/MF A01 CSCL 09C

The results of a one year study to: (1) develop a theory for Robust Failure Detection and Identification (FDI) in the presence of model uncertainty, (2) develop a design methodology which utilizes the robust FDI ththeory, (3) apply the methodology to a sensor FDI problem for the F-100 jet engine, and (4) demonstrate the application of the theory to the evaluation of alternative FDI schemes are presented. Theoretical results in statistical discrimination are used to evaluate the robustness of residual signals (or parity relations) in terms of their usefulness for FDI. Furthermore, optimally robust parity relations are derived through the optimization of robustness metrics. The result is viewed as decentralization of the FDI process. A general structure for decentralized FDI is proposed and robustness metrics are used for determining various parameters of the algorithm. Author

N86-16487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION AND TEST RESULTS OF A VARIABLE SPEED, CONSTANT FREQUENCY GENERATING SYSTEM Final Report
Frank J. Brady Dec. 1985 18 p refs
(Contract DE-AI01-76ET-20320)
(NASA-TM-87181; DOE/NASA/20320-67; E-2830; NAS 1.15:87181) Avail: NTIS HC A02/MF A01 CSCL 09C

The variable-speed, constant frequency generating system developed for the Mod-0 wind turbine is presented. This report describes the system as it existed at the conclusion of the project. The cycloconverter control circuit is described including the addition of field-oriented control. The laboratory test and actual wind turbine test results are included. Author

N86-16488# Arizona State Univ., Tempe. Center for Solid State Science.
TRANSPORT OF ANION IMPURITIES THROUGH OXIDES Final Report, 1 Jul. 1981 - 30 Jun. 1985
J. B. Wagner, Jr. 2 Jul. 1985 42 p
(Contract DAAG29-81-K-0109)
(AD-A158445; ARO-18043.7-MS) Avail: NTIS HC A03/MF A01 CSCL 07/4

This research was divided into four interrelated parts. It was an outgrowth of an investigation on the corrosion of nickel in SO2+Ar and in SO2+SO3+Ar gas mixtures at 800 C. From the earlier studies it became clear that the transport properties of the sulfide, the oxidation of the sulfide itself and the transport properties of the duplex scale were needed data. In addition, the thermodynamics of the sulfides were needed. Accordingly the following research was performed: (1) Transport Properties of Ni3+ or - xS2 a) electrical conductivity b) chemnical diffusivity c) radio tracer sulfur diffusion; (2) Gibbs Free Energy of Ni3 + or - xS2 and Fe1-xS by Galvanci Cells; (3) Oxidation of Ni3 + or - xS2 in oxygen at 700 C; (4) Transport in NiO-Ni3S2 composites. In what follows, a brief summary of each research objective is presented followed by the publications and extended abstracts which contain the details. GRA

N86-16489# IIT Research Inst., Rome, N.Y.
IMPACT OF NONOPERATING PERIODS ON EQUIPMENT RELIABILITY Final Report, Feb. 1983 - Sep. 1984
D. W. Coit and M. G. Priore May 1985 440 p
(Contract F30602-83-C-0056)
(AD-A158843; RADC-TR-85-91) Avail: NTIS HC A19/MF A01 CSCL 20/3

The objective of this study was to develop a procedure to predict the quantitative effects of nonoperating periods on electronic equipment reliability. A series of nonoperating failure rate prediction models were developed at the component level. The models are capable of evaluating component nonoperating failure rate for any anticipated environment with the exception of a satellite environment. The proposed nonoperating failure rate prediction methodology is intended to provide the ability to predict the component nonoperating failure rate and reliability as a function of the characteristics of the devices, technology employed in producing the device, and external factors such as environmental stresses which have a significant effect on device nonoperating reliability. The prediction methodology is presented in a form compatible with MIL-HDBK-217 as an Appendix to the technical report. GRA

N86-16490# Naval Research Lab., Washington, D. C.
LONG PULSE E-BEAM CONTROLLED SWITCH: DESCRIPTION OF APPARATUS AND INITIAL RESULTS
J. Burton, V. E. Scherrer, R. J. Commisso, R. F. Fernsler, and I. M. Vitkovitsky 30 Aug. 1985 33 p
(AD-A159125; NRL-MR-5628) Avail: NTIS HC A03/MF A01 CSCL 09/5

There exists an interest in the application of externally controlled high pressure, volume discharges to high power switching. Important applications involve opening switches for both single and repetitively pulsed, high power, inductive generators. Such discharges have great potential for these applications because they can recover rapidly to the original highly resistive state of the gas once the external ionizing agent is removed. Several authors have reported on experiments and theoretical investigations in which an electron beam is used as the external agent to sustain the diffuse discharge. The design of an inductive store system that employs and electron-beam controlled switch to produce a 280 kV, 10 kA, 60 ns full width at half maximum pulse is described. Included in the design are the electron-beam generator, electron-beam diode, and electron-beam controlled switch. The voltage is generated across an open circuit load. These non-optimized results agree with predictions from a previously described design procedure. GRA

N86-16491# Mission Research Corp., Albuquerque, N. Mex.
MILLIMETER WAVE VIRCATOR Final Report, 1 Jan. 1982 - 31 Mar. 1985
D. J. Sullivan, D. E. Voss, R. J. Adler, K. O. Busby, and E. M. Bollen Jun. 1985 272 p
(Contract F49620-82-C-0014)
(AD-A159394; AMRC-R-692; AFOSR-85-0666TR) Avail: NTIS HC A12/MF A01 CSCL 09/1

The millimeter wave vircator has achieved a frequency in excess of 39.9 Ghz and a peak power of the order of 21 kilowatts (f > or = 26.35 GHz) for a pulse duration of as short as 5 ns

full width at half maximum. A new moderate voltage, high current density, field emission gun has been tested to a voltage, high current density, field emission gun as been tested to a voltage of 67 kV and an inferred current density of 7 kA/per sq cm. A new compact capacitive voltage monitor, similar to those commonly used in radar modulators, has been developed for short pulse, fast risetime, low to moderate impedance pulse lines. GRA

N86-16492# Pacific Northwest Lab., Richland, Wash.
OPTICAL PROPERTIES OF SOLID PARTICLE RECEIVER MATERIALS. 22: DIFFUSE REFLECTANCE OF NORTON MASTERBEADS AT ELEVATED TEMPERATURES
K. A. Stahl, J. W. Griffin, and R. B. Pettit 1985 18 p Presented at the SPIE International Technical Symposium on Optical and Electro-Optical Engineers, San Diego, Calif., 18 Aug. 1985 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contracts DE-AC06-76RL-01830; DE-AC04-76DP-00789)
(DE85-015495; SAND-85-0413C; CONF-850887-15) Avail: NTIS HC A02/MF A01

An experimental system to measure the diffuse reflectance of a particulate sample over the wavelength range of 300 to 2500 nm and at elevated temperatures up to 1000 C was developed and implemented. A description of the experimental apparatus and measurement procedures, as well as optical reflectance data for Masterbeads, are presented. Using the high temperature measurement system, the diffuse reflectance of Masterbeads changed by less than 1% for sample temperatures from 150 C to 930 C. However, after heating a sample for 3 hours at 1000 C in air, the solar absorptance measured at room temperature decreased from an initial value of 0.93 to 0.89. DOE

N86-16493# Allied Bendix Aerospace, Kansas City, Mo.
USE OF THE FINITE ELEMENT METHOD FOR CALCULATING CAPACITANCE VALUES IN ELECTRICAL AND ELECTRONIC COMPONENTS
J. F. Mahoney Jul. 1985 25 p
(Contract DE-AC04-76DP-00613)
(DE85-016333; BDX-613-3321) Avail: NTIS HC A02/MF A01

Using the COSMIC/NASTRAN computer program, the Finite Element Method was applied to determine the capacitance of a specific diode. Preparatory work included literature searches of techniques used in industry and application of COSMIC/NASTRAN to electrostatic test cases. Capacitance values of the diode were calculated and a normalized voltage potential plot was generated. DOE

N86-16494# Sandia Labs., Albuquerque, N. Mex.
EMP-INDUCED, TIME-DOMAIN GRAZING SOLUTION FOR AN INFINITE WIRE OVER THE GROUND
K. C. Chen and K. M. Damrau May 1985 38 p
(Contract DE-AC04-76DP-00789)
(DE85-017298; SAND-85-0222) Avail: NTIS HC A03/MF A01

The EMP-induced, time-domain current waveform is obtained for an infinite wire over the ground under grazing incidence. In contrast to previous results, the maximum grazing current is found to be slightly larger when the ground conductivity is higher. Also, the grazing angle for maximum current is found to be smaller when the ground conductivity is higher. For a ground conductivity of 1/10 sq S/m, the maximum current is approximately a factor of five larger than typical value reported in the literature. A byproduct of this study is a simple formula of ground inductance for the transmission line mode. DOE

N86-16495# California Univ., Berkeley. Lawrence Berkeley Lab.
TECHNOLOGY BASE RESEARCH PROJECT FOR ELECTROCHEMICAL ENERGY STORAGE Annual Report, 1984
K. Kinoshita, ed. 23 Jun. 1985 134 p
(Contract DE-AC03-76SF-00098)
(DE85-016497; LBL-19545) Avail: NTIS HC A07/MF A01

The DOE Electrochemical Energy Storage Program is divided into two projects: (1) the exploratory technology development and testing (ETD) project and (2) the technology base research (TBR) project. The role of the TBR Project is to perform supporting research for the advanced battery systems under development by the ETD Project, and to evaluate new systems with potentially superior performance, durability and/or cost characteristics. The specific goal of the TBR Project is to identify the most promising electrochemical technologies and transfer them to industry and/or the ETD Project for further development and scale-up. This report summarizes the research, financial, and management activities relevant to the TBR Project in CY 1984. General problem areas addressed by the project include identification of new electrochemical couples for advanced batteries, determination of technical feasibility of the new couples, improvements in battery components and materials, establishment of engineering principles applicable to electrochemical energy storage and conversion, and the assessment of fuel-cell technology for transportation applications. Major emphasis is given to applied research which will lead to superior performance and lower life-cycle costs. The TBR Project is divided into three major project elements: exploratory research, applied science research, and air systems research. DOE

N86-16496# Sandia National Labs., Albuquerque, N. Mex.
ELECTRON FLOW AND IMPEDANCE OF AN 18-BLADE FRUSTUM DIODE
T. W. L. Sanford, J. R. Lee, J. A. Halbleib, J. P. Quintenz, R. S. Coats, W. A. Stygar, R. E. Clark, D. L. Faucett, D. Webb, and C. E. Heath Jul. 1985 37 p Prepared in cooperation with Pulse Sciences, Inc., San Leandro, Calif.
(Contract DE-AC04-76DP-00789)
(DE85-016200; SAND-84-1424) Avail: NTIS HC A03/MF A01

A new, large-area, high-uniformity, flash X-ray source that efficiently couples electrical energy to photon energy was successfully constructed and tested on the 1 MV, 2 MA electron accelertor SPEED. The source employs 18 individual blade-diodes arranged in the configuration of a frustum. Each blade was magnetically isolated on the real-cathode side of an anode foil, but not on the virtual-cathode side. The operation of the diode was heavily diagnosed using 24 Rogowski coils, a vacuum voltage monitor, pin diode detectors, an 80-element TLD array, and a fast-framing X-ray pinhole camera. The individual blade-diodes were found to exhibit line pinching, end-to-end pinching, and minimal electron reflexing through the Ta anode foil, with a radiation yield that agreed with Monte Carlo simulations. The end-to-end pinch location could be controlled by tapering the anode-cathode gap. The impedance depended on only the smallest spacing, and was independent of pinch location. DOE

N86-16497# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF SYNTHETIC TAPE INSULATION FOR BOTH CRYOGENIC AND AMBIENT TEMPERATURE POWER CABLES
E. B. Forsyth 1985 10 p Presented at the 18th Symposium on Electrical Insulating Materials, Tokyo, Japan, 30 Sep. 1985
(Contract DE-AC02-76CH-00016)
(DE85-015180; BNL-36690; CONF-8509124-1) Avail: NTIS HC A02/MF A01

This report is on the development of synthetic tape insulation for both cryogenic and ambient temperature power cables. The report begins with an explanation of electrical insulation for superconducting power cables, explaining three major methods of insulating: (1) gas insulated systems; (2) lapped tape insulated conductor impregnated with coolant; and (3) extruded polyethylene insulation. Advantages and disadvantages of the methods are briefly explained, and the development of ambient temperature insulation is also touched upon. DOE

N86-16498# Argonne National Lab., Ill.
LI-ALLOY/FeS CELL DESIGN AND ANALYSIS REPORT
E. C. Gay, R. K. Steunenberg, W. E. Miller, J. E. Battles, T. D. Kaun, F. J. Martino, J. A. Smaga, and A. A. Chilenskas Jul. 1985 183 p
(Contract W-31-109-eng-38)
(DE85-016238; ANL-84-93) Avail: NTIS HC A09/MF A01

This report contains historical information on the Li-alloy/FeS

system that will be useful in its future applications. This document includes the following: (1) the chemical and electrochemical reactions for the Li-alloy/FeS system, accomplishments in past cell development efforts, and performance attained by state-of-the-art cells vs performance goals; (2) detailed drawings of state-of-the-art cell designs, documentation of cell fabrication techniques, and comparisons of alternative types of cell components (such as BN felt vs MqO powder separators, stainless vs low-carbon steel cell housings) and fabrication techniques (such as vs uncharged electrodes); (3) results of posttest cell analyses, including cell failure mechanisms, electrode morphology and active material distribution, and in-cell corrosion rates; (4) data from trade-off studies between specific power and energy; (5) discussion of battery design considerations (e.g., volumetric energy density, battery charger, and high-efficiency thermal insulation); (6) results of cost studies, which include materials and manufacturing costs of cells and batteries and heating costs involved in battery operation; and (7) projections of cell designs having the greatest potential for meeting electric-vehicle performance requirements. DOE

N86-16499# Department of Energy, Washington, D. C.
DISK FILTER Patent Application
W. Bergman, inventor (to DOE) (California Univ., Livermore, Lawrence livermore Lab.) Filed 9 Jan. 1985 14 p
(Contract W-7404-eng-48)
(DE85-017752; US-Patent-Appl-SN-690023) Avail: NTIS HC A02/MF A01

An electric disk filter provides a high efficiency at high temperature. A hollow outer filter of fibrous stainless steel forms the ground electrode. A refractory filter material is placed between the outer electrode and the inner electrically isolated high voltage electrode. Air flows through the outer filter surfaces through the electrified refractory filter media and between the high voltage electrodes and is removed from a space in the high voltage electrode. DOE

N86-16500# Sandia National Labs., Albuquerque, N. Mex.
QUALIFICATION OF RADIATION-HARD DIELECTRICS FOR CAPACITOR APPLICATIONS
S. R. Kurtz, C. Arnold, Jr., and L. R. Edwards 1985 13 p Presented at the Conference on Electrical Insulation and Dielectrics, Amherst, N.Y., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014640; SAND-85-0723C; CONF-8510114-1) Avail: NTIS HC A02/MF A01

Specific polymer dielectric materials have been identified that can be used to minimize the discharge of capacitors upon exposure to ionizing radiation. The testing procedures used to qualify the radiation-induced conductivity in capacitor dielectrics are discussed, and a comparison is made of various radiation-hard dielectrics that display low levels of radiation-induced conductivity. DOE

N86-16501# Los Alamos National Lab., N. Mex.
THERMIONIC INTEGRATED CIRCUITS: ELECTRONICS FOR HOSTILE ENVIRONMENTS
D. K. Lynn, J. B. McCormick, M. D.J. MacRoberts, D. K. Wilde, G. R. Dooley, and D. R. Brown 1985 19 p Presented at the 22nd Annual Conference on Nuclear and Space Radiation Effects, Monterey, Calif., 22 Jul. 1985
(Contract W-7405-eng-36)
(DE85-015680; LA-UR-85-2336; CONF-850711-16) Avail: NTIS HC A02/MF A01

Thermionic integrated circuits combine vacuum tube technology with integrated circuit techniques to form integrated vacuum triode circuits. These circuits are capable of extended operation in both high-temperature and high-radiation environments. DOE

N86-16502# Sandia National Labs., Albuquerque, N. Mex.
CHARACTERIZATION OF DEB POWDERS AND PELLETS FOR CA/CaCr04 THERMAL BATTERIES
R. A. Guidotti and F. W. Reinhardt Jul. 1985 51 p
(Contract DE-AC04-76DP-00789)
(DE85-017250; SAND-83-2270) Avail: NTIS HC A04/MF A01

A detailed characterization study was conducted of catholyte or depolarizer-electrolyte-binder (DEB) mixes used in Ca/CaCrO4 thermal batteries. A number of the physical and chemical properties of powders and pellets of the DEB mixes were examined for correlation to electrochemical performance in 5-cell and, to a lesser extent, single-cell batteries. Powder characteristics evaluated included: chemical composition, segregation, flowability, bulk density, and BET surface area. Pellet characteristics evaluated included: break strength, forming force, electrolyte leakage at 400C after 0.5 h, and deformation at 530C under an applied pressure of 71 kPa (10.3 psi). Three series of DEB mixes were formulated at constant D/E weight ratios of 0.50, 0.64, and 0.80 to study the effect of SiO2 binder at concentrations of 8 to 12 wt%. Three additional series of DEB mixes were formulated at constant E/B weight ratios of 4.5, 5.5, and 6.5 to study the effect of CaCrO4 depolarizer at concentrations of 30 to 40 wt%. The BET surface area and chemical composition of DEB powders, and the electrolyte leakage and deformation of DEB pellets, could be correlated to the activated lives and pulse characteristics of the 5-cell batteries built with these mixes. DOE

N86-16503# Oak Ridge National Lab., Tenn.
THE ac RESPONSE OF FRACTAL INTERFACES
S. H. Liu, T. Kaplan, and L. J. Gray Aug. 1985 8 p Presented at the 5. International Conference on Solid-state Ionics, Lake Tahoe, Calif., 18 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017307; CONF-850870-1) Avail: NTIS HC A02/MF A01

The small signal ac impedance of the interface between a blocking electrode and an aqueous or solid electrolyte often contains a constant-phase-angle (CPA) element whose impedance has the frequency dependence according to Z proportional to (j(LC omega)) sup eta. Recently it has been demonstrated experimentally that the exponent eta is intimately related to the roughness of the interface, with eta approaching 1 when the surface is made increasingly smooth. We propose to model the interface by a fractal called Cantor bar. The equivalent circuit of the model has the property of the CPA element with the exponent eta = 3 - ds, where $2 < ds < 3$ is the fractal dimension of the interface. The model has been made more realistic by assuming random branching number and scaling ratio, and the relation between eta and ds remains the same. For real fractal surfaces the relation between eta and ds may hold approximately. DOE

N86-16504# Department of Energy, Washington, D. C.
THERMOACOUSTIC MAGNETOHYDRODYNAMIC ELECTRICAL GENERATOR Patent Application
J. C. Wheatley (Los Alamos National Lab., New Mexico), G. W. Swift, and A. Migliori, inventors (to DOE) Filed 16 Nov. 1984 15 p
(Contract W-7405-eng-36)
(DE85-017768; US-Patent-Appl-SN-672228) Avail: NTIS HC A02/MF A01

A thermoacoustic magnetohydrodynamic electrical generator includes an intrinsically irreversible thermoacoustic heat engine coupled to a magnetohydrodynamic electrical generator. The heat engine includes an electrically conductive liquid metal as the working fluid and includes two heat exchange and thermoacoustic structure assemblies which drive the liquid in a push-pull arrangement to cause the liquid metal to oscillate at a resonant acoustic frequency on the order of 1000 Hz. The engine is positioned in the field of a magnet and is oriented such that the liquid metal oscillates in a direction orthogonal to the field of the magnet, whereby an alternating electrical potential is generated in the liquid metal. Low-loss, low-inductance electrical conductors electrically connected to opposite sides of the liquid metal conduct an output signal to a transformer adapted to convert the low-voltage, high-current output signal to a more usable higher voltage, lower current signal. DOE

N86-16505# Oak Ridge National Lab., Tenn.
ZnO VARISTORS MADE FROM POWDERS PRODUCED UTILIZING A UREA PROCESS

E. Sonder, T. C. Quinby, and D. L. Kinser Sep. 1985 23 p
(Contract DE-AC05-84OR-21400)
(DE85-018076; ORNL/TM-9728) Avail: NTIS HC A02/MF A01

Small-grained oxide powders of uniform composition, ideally suited for varistor production, have been prepared as follows: ZnO and other components are dissolved in nitric acid. Urea is added and the mixture is heated to remove water and nitrates and to form solid melamine. The melamine is then calcined to burn off the organics and to produce fine oxide powders. Grain sizes, densities, and electrical characteristics have been measured for varistors fabricated from these powders by sintering or hot pressing. The densities and grain sizes increase with processing temperature, the nonlinearity coefficient depends primarily on composition, and the average voltage per barrier for sintered samples is approximately 2.5 eV. The breakdown field for hot-pressed samples is not uniform for different slices of the same varistor and depends on variables other than the grain size. DOE

N86-16506# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
METHODS FOR THE ANALYSIS OF LITHIUM-SILICON, IRON DISULFIDE THERMAL BATTERY MATERIALS
P. R. Krall 30 Sep. 1985 34 p
(Contract DE-AC04-76DP-00656)
(DE85-018331; GEPP-TIS-849) Avail: NTIS HC A03/MF A01

Analytical methods for the characterization of the lithium-silicon/iron disulfide thermal battery materials have been developed and evaluated. The standard procedures being used for the quality control testing of the battery materials are described in this report. These procedures are based on both classical chemical methods and instrumental methods of analysis. The materials characterized include lithium-silicon alloy, iron disulfide, catholyte material, separator material, calcium disilicide, depolarizer-electrolyte-binder material, electrolyte and electrolyte binder material. DOE

N86-16507# International Trade Administration, Washington, D.C. Nonferrous Metals Div.
STORAGE BATTERY MARKET: PROFILES AND TRADE OPPORTUNITIES
D. Stonfer Apr. 1985 55 p
(DE85-901842; NP-5901842) Avail: NTIS HC A04/MF A01

The export market for domestically produced storage batteries is a modest one, typically averaging 6 to 7% of domestic industry shipments. Exports in 1984 totalled about $167 million. Canada and Mexico were the largest export markets for US storage batteries in 1984, accounting for slightly more than half of the total. The United Kingdom, Saudi Arabia, and the Netherlands round out the top five export markets. Combined, these five markets accounted for two-thirds of all US exports of storage batteries in 1984. On a regional basis, the North American (Canada), Central American, and European markets accounted for three-quarters of total storage battery exports. Lead-acid batteries accounted for 42% of total battery exports. Battery parts followed lead-acid batteries with a 29% share. Nicad batteries accounted for 16% of the total while other batteries accounted for 13%. DOE

N86-16508# Oak Ridge National Lab., Tenn.
EVALUATION OF SEVERAL POLYMER FILMS FOR USE AS ELECTRICAL INSULATORS
H. E. McCoy, Jr. and C. R. Brinkman 1985 17 p Presented at the Electrical/Electronics Insulation Exposition, Boston, Mass., 30 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017088; CONF-8509141-1) Avail: NTIS HC A02/MF A01

Samples of polyethylene terephthalate, polycarbonate, polyparabanic acid, polyethersulfone, and polyimide were aged to 32,700 h in SF6. The temperatures evaluated were 70, 110, 135, and 160C. The influence of aging was determined by post-aging electrical breakdown tests, tensile tests, and density measurements. There was no indication that aging lowered the electrical breakdown voltage. The tensile properties were altered to some extent for all polymers, but large differences in behavior were noted. Density measurements on polyethylene terephthalate showed that the crystallinity of this material increased during aging. Surface crystal growth noted in the scanning electron microscope gave further evidence of morphological changes in this material. Creep tests were run on several polymers: polyethylene terephthalate had the lowest creep strength, and polyimide had the highest. Strain cycle experiments showed that when polyethylene terephthalate and aluminum were bonded together, the high thermal expansion of the aluminum could pull the polymer in two during thermal cycling. DOE

N86-16509# Pacific Northwest Lab., Richland, Wash.
RELIABILITY MODELLING SYSTEM FOR ANALYSIS OF ADVANCED BATTERY TECHNOLOGIES
C. H. Imhoff, C. J. Hostick, and R. K. Nakaoka May 1985 8 p Presented at the 20th Intersociety Energy Conversion Engineering Conference, Miami Beach, Fla., 18 Aug. 1985
(Contract DE-AC06-76RL-01830)
(DE85-017464; PNL-SA-13209; CONF-850808-22) Avail: NTIS HC A02/MF A01

Key considerations in evaluating the reliability of advanced battery technologies include the impact of cell failures on battery performance and cost. Pacific Northwest Laboratory developed interactive microcomputer based simulation models to help battery developers use cell reliability data to calculate the expected performance of new battery technologies. Key benefits of this model include its capability to estimate the effect of cell failures upon: (1) battery system discharge performance, (2) system cycle life, and (3) system economic performance (tradeoffs between capital investment and lifetime operating costs). DOE

N86-16510# Department of Energy, Washington, D. C.
MICROWAVE COUPLER AND METHOD Patent Application
C. E. Holcombe, inventor (to DOE) Filed 29 Nov. 1984 16 p
(Contract DE-AC05-84OR-21400)
(DE85-017728; US-Patent-Appl-SN-676342) Avail: NTIS HC A02/MF A01

The present invention is directed to a microwave coupler for enhancing the heating or metallurgical treatment of materials within a cold-wall, rapidly heated cavity as provided by a microwave furnace. The coupling material of the present invention is an alpha-rhombohedral-boron-derivative-structure material such as boron carbide or boron silicide which can be appropriately positioned as a susceptor within the furnace to heat other material or be in powder particulate form so that composites and structures of boron carbide such as cutting tools, grinding wheels and the like can be rapidly and efficiently formed within microwave furnaces. DOE

N86-16511# Pacific Northwest Lab., Richland, Wash.
MISSION AND STATUS OF THE US DEPARTMENT OF ENERGY'S BATTERY ENERGY STORAGE PROGRAM
J. E. Quinn, J. W. Hurwitch, A. R. Landgrebe, and S. G. Hauser May 1985 10 p Presented at the 20th Intersociety Energy Conversion Engineering Conference, Miami Beach, Fla., 18 Aug. 1985
(Contract DE-AC06-76RL-01830)
(DE85-017893; PNL-SA-13213; CONF-850808-23) Avail: NTIS HC A02/MF A01

The mission of the US Department of Energy's battery research program has evolved to reflect the changing conditions of the world energy economy and the national energy policy. The battery energy storage program supports the goals of the National Energy Policy Plan (FY 1984). The goals are to provide an adequate supply of energy at reasonable costs, minimize federal control and involvement in the energy marketplace, promote a balanced and mixed energy resource system, and facilitate technology transfer from the public to the private sector. This paper describes the history of the battery energy storage program and its relevance to the national interest. Potential market applications for battery energy storage are reviewed, and each technology, its goals, and its current technical status are described. The paper concludes by describing the strategy developed to ensure effective technology

transfer to the private sector and reviewing past significant accomplishments. DOE

N86-16512# Los Alamos National Lab., N. Mex.
GATED SIT VIDICON STREAK TUBE
D. L. Dunbar, G. J. Yates, and J. P. Black 1985 7 p Presented at the SPIE International Technical Symposium on Optical and Electro-optical Engineers, San Diego, Calif., 18 Aug. 1985 Prepared in cooperation with Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.
(Contract W-7405-eng-36)
(DE85-017549; LA-UR-85-2928; CONF-850887-32) Avail: NTIS HC A02/MF A01

A recently developed prototype streak tube designed to produce high gain and resolution by incorporating the streak and readout functions in one envelope thereby minimizing photon-to-change transformations and eliminating external coupling losses is presented. The tube is based upon a grid-gated Silicon-Intensified-Target Vidicon (SITV) with integral Focus Projection Scan (FPS) TV readout. Demagnifying electron optics (m=0.63) in the image section map the 40-mm-diameter photocathode image unto a 25-mm-diameter silicon target where gains greater than or equal to 1000 are achieved with only 10 KV accelerating voltage. This is compared with much lower gains (approx.50) at much higher voltages (approx.30 KV) reported for streak tubes using phosphor screens. Because SIT technology is well established means for electron imaging in vacuum, such fundamental problems as backside thinning required for electron imaging unto CCDs do not exist. The high spatial resolution (approx.30 lp/mm), variable scan formats, and high speed electrostatic deflection (250 sq mm areas are routinely rastered with 256 scan lines in 1.6 ms) available from FPS readout add versatility not available in CCD devices. Theoretical gain and spatial resolution for this design (developed jointly by Los Alamos National Laboratory and General Electric Co.) are compared with similar calculations and measured data obtained for RCA 73435 streaks fiber optically coupled to: (1) 25-mm-diameter SIT FPS vidicons, and (2) 40-mm-diameter MCPTs (proximity-focused microchannel plate image intensifier tubes) fiber optically coupled to 18-mm-diameter Sb2S3 FPS vidicons. Sweep sensitivity, shutter ratio, and record lengths for nanosecond duration (20 to 200 ns) streak applications are discussed. DOE

N86-16513# Department of Energy, Washington, D. C.
LOW VOLTAGE SOLID-STATE LATERAL COLORATION ELECTROCHROMIC DEVICE Patent Application
C. E. Tracy (Midwest Research Inst., Golden, Colo.), D. K. Benson (Midwest Research Inst., Golden, Colo.), and M. R. Ruth, inventors (to DOE) (Midwest Research Inst., Golden, Colo.) Filed 21 Dec. 1984 18 p
(Contract DE-AC02-83CH-10093)
(DE85-017742; US-Patent-Appl-SN-685177) Avail: NTIS HC A02/MF A01

A solid-state transition metal oxide device comprising a plurality of layers having a predisposed orientation including an electrochromic oxide layer. Conductive material including anode and cathode contacts is secured to the device. Coloration is actuated within the electrochromic oxide layer after the application of a predetermined potential between the contacts. The coloration action is adapted to sweep or dynamically extend across the length of the electrochromic oxide layer. DOE

N86-16514# Department of Energy, Washington, D. C.
LOG AMPLIFIER WITH POLE-ZERO COMPENSATION Patent Application
W. Brookshier, inventor (to DOE) (Argonne National Lab., Ill.) Filed Feb. 1985 14 p
(Contract W-31-109-eng-38)
(DE85-017796; US-Patent-Appl-SN-699878) Avail: NTIS HC A02/MF A01

A logarithmic amplifier circuit provides pole-zero compensation for improved stability and response time over 6 to 8 decades of input signal frequency. The amplifer circuit includes a first operational amplifier with a first feedback loop which includes a second, inverting operational amplifier in a second feedstock loop. The compensated output signal is provided by the second operational amplifier with the log elements, i.e., resistors, and the compensating capacitors in each of the feedback loops having equal values so that each break point is offset by a compensating break point or zero. DOE

N86-16437# Joint Publications Research Service, Arlington, Va.
COMPOSITE ELECTRIC CONTACT MATERIALS
Jacek Senkara and Jan Kowalczyk *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 48-49 Repr. from Polish Technical Review (Warsaw, Poland), no. 2-3, 1985 p 9-10 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

N86-16442# University of Electro-Communications, Tokyo (Japan).
THE STUDY IN SUB E CLASS CONVERTER WITH SATURATING CORES
Toshimitsu Suzuki, Koichi Usami, and Sonosuke Yamanaka *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 9-13 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

N86-16463# Selenia S.p.A., Rome (Italy). Research Dept.
AN INTRODUCTION TO THE DESIGN OF MICROWAVE FERRITE DEVICES
Riccardo Roveda, Carlo diGregorio, and Nicola Scafuro *In its* Rivista Tecnica Selenia, Vol. 9, No. 2, 1985 1985 p 1-11 refs (For primary document see N86-16462 07-32)
Avail: NTIS HC A03/MF A01

N86-16925# Joint Publications Research Service, Arlington, Va.
SELF-TESTING AND REDUNDANCY IN VERY LARGE MEMORY MICROCIRCUITS
A. S. Berezin, Ye. M. Onishchenko, and S. V. Sushko *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 20 Transl. into ENGLISH from Mikroelektronika (Moscow, USSR), no. 2, Mar.-Apr. 1985 p 99-102 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

N86-16926# Joint Publications Research Service, Arlington, Va.
DESIGN OF MEMORY TESTS ON THE BASIS OF ANALYSIS OF SEQUENCES OF FUNCTIONAL OPERATORS
A. V. Grinshteyn and G. Kh. Novik *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 20-21 Transl. into ENGLISH from Mikroelektronika (Moscow, USSR), no. 2, Mar.-Apr. 1985 p 103-109 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

N86-16927# Joint Publications Research Service, Arlington, Va.
NOISE CHARACTERISTICS OF STROBOSCOPIC CONVERTERS BASED ON GALLIUM ARSENIDE INTEGRATED MICROCIRTCUITS
V. I. Staroselskiy *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 22 Transl. into ENGLISH from Mikroelektronika (Moscow, USSR), no. 2, Mar.-Apr. 1985 p 162-168 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-16515 Dayton Univ., Ohio.
UNSTEADY HEAT TRANSFER IN HEAT PIPES Ph.D. Thesis
Jerry Edward Beam 1985 127 p
Avail: Univ. Microfilms Order No. DA8513704

The purpose was to investigate the unsteady heat transfer associated with a heat pipe during start up operation. Initial studies were conducted with a variety of heat pipe screen wick configurations in order to develop a mathematical expression for the flow velocity of a fluid inducted by the capillary structure of the wick. This mathematical model was solved first numerically and then simplified to provide a closed form solution. The results were compared with the experimental data and proved to provide consistent results with plus or minus 10%. A lumped parameter model of the heat pipe was next developed so that the transient operation of the heat pipe could be predicted. Upon evalaution of the model it was shown that the model and the experimental data agreed quite well in overall performance but an initial period of performance was identified where the experimental results differed significantly from the lumped parameter model. During this initial period of operation, large temperature gradients were observed, and it was theorized that the effect was a result of the interdependence of the hydrodynamics and the heat transfer characteristics of the heat pipe. Dissert. Abstr.

N86-16516 British Library Lending Div., Boston Spa (England).
CALCULATING THE INITIAL STAGE OF THE UNSYMMETRICAL HEATING OF A PLATE
Yu. V. Vidin [1985] 7 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii Chernaya Metallurgiya (USSR), no. 3, 1985 p 112-115
(BLL-M-36434-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The mathematics involved in working out an effective analytical method of calculating the unsymmetrical temperature fields in steel plates of infinite size during the initial stages of their heating by convection currents are presented. E.A.K.

N86-16517*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SECOND-ORDER CLOSURE MODELS FOR ROTATING TURBULENT FLOWS Final Report
Charles G. Speziale Oct. 1985 26 p refs Submitted for publication
(Contract NAS1-17070)
(NASA-CR-178005; ICASE-85-49; NAS 1.26:178005) Avail: NTIS HC A03/MF A01 CSCL 20D

The physical properties of the commonly used second-order closure models are examined theoretically for rotating turbulent flows. Comparisons are made with results which are a rigorous consequence of the Navier-Stokes equations for the problem of a fully-developed turbulent channel flow in a rapidly rotating framework. It is demonstrated that all existing second-order closures yield spurious physical results for this test problem of rotating channel flow. In fact, the results obtained are shown to be substantially more unphysical than those obtained from the simpler K-epsilon and K-l models. Modifications in the basic structure of these second-order closure models are proposed which can alleviate this problem. Author

N86-16518*# Tennessee Univ. Space Inst., Tullahoma.
MEAN VELOCITY AND TURBULENCE MEASUREMENTS IN A 90 DEG CURVED DUCT WITH THIN INLET BOUNDARY LAYER Final Report, Apr. 1982 - Sep. 1984
R. A. Crawford, C. E. Peters, J. Steinhoff, J. O. Hornkohl, J. Nourinejad, and K. Ramachandran Dec. 1985 188 p refs
(Contract NAS3-23278)
(NASA-CR-174811; NAS 1.26:174811; UTSI/85-08) Avail: NTIS HC A09/MF A01 CSCL 02D

The experimental database established by this investigation of the flow in a large rectangular turning duct is of benchmark quality. The experimental Reynolds numbers, Deans numbers and boundary layer characteristics are significantly different from previous benchmark curved-duct experimental parameters. This investigation extends the experimental database to higher Reynolds number and thinner entrance boundary layers. The 5% to 10% thick boundary layers, based on duct half-width, results in a large region of near-potential flow in the duct core surrounded by developing boundary layers with large crossflows. The turbulent entrance boundary layer case at R sub ed = 328,000 provides an incompressible flowfield which approaches real turbine blade cascade characteristics. The results of this investigation provide a challenging benchmark database for computational fluid dynamics code development. Author

N86-16519*# Wisconsin Univ., Milwaukee. Dept. of Mechanical Engineering.
IMPROVEMENT OF THE SECOND- AND THIRD-MOMENT MODELING OF TURBULENCE: A STUDY OF REYNOLDS-STRESS CLOSURE MODEL Semiannual Progress Report, 15 Jul. 1985 - 15 Jan. 1986
R. S. Amano and P. Goel Jan. 1986 96 p refs
(Grant NAG3-546)
(NASA-CR-176478; NAS 1.26:176478; Rept-94E/2623E; TF/86/1) Avail: NTIS HC A05/MF A01 CSCL 20D

Four parts of the Reynolds-stress closure modeling are reported: (1) improvement of the k and epsilon equaitons; (2) development of the third-moment transport equation; (3) formulation of the diffusion coefficient of the momentum equation by using the algebraic-stress model of turbulence; and (4) the application of the Reynolds-stress model to a heat exchanger problem. It was demonstrated that the third-moment transport model improved the prediction of the triple-velocity products in the recirculating and reattaching flow regions in comparison with the existing algebraic models for the triple-velocity products. Optimum values for empirical coefficients are obtained for the prediction of the backward-facing step flows. A functional expression is derived for the coefficient of the momentum diffusion by employing the algebraic-stress model. The second-moment closure is applied to a heat transfer problem. The computations for the flow in a corrugated-wall channel show that the second-moment closure improves the prediction of the heat transfer rates by 30% over the k - epsilon model. E.A.K.

N86-16520# Maryland Univ., College Park. Center for Automation Research.
ON THE UNIQUENESS OF IMAGE FLOW SOLUTIONS FOR PLANAR SURFACES IN MOTION
M. Subbarao and A. M. Waxman Apr. 1985 39 p
(Contract DAAK70-83-K-0018; DARPA Order 3206)
(AD-A158705; CAR-TR-114; CS-TR-1485) Avail: NTIS HC A03/MF A01 CSCL 20/4

Two important results relating to the uniqueness of image flow solutions for planar surfaces in motion are presented here. These results relate to the formulation of the image flow problem by Waxman and Ullman which is based on a kinematic analysis of the image flow field. The first result concerns resolving the duality of interpretations that are generally associated with the instantaneous image flow of an evolving image sequence. It is shown that the interpretation for orientation and motion of planar surfaces is unique when either two successive image flows of one planar surface patch are given or one image flow of two planar patches moving as a rigid body is given. This document has proved this by driving explicit expressions for the evolving solution of an image flow sequence with time. These expressions can be used to resolve this ambiguity of interpretation in practical problems. The second result is the proof of uniqueness for the velocity of approach which satisfies the image flow equations for

planar surfaces derived in Waxman's and Ullman's document. In addition, it is shown that this velocity can be computed as the middle root of a cubic equation. These two results together suggest a new method for solving the image flow problem for planar surfaces in motion. Author (GRA)

N86-16521# Calspan Field Services, Inc., Arnold AFS, Tenn.
INVESTIGATION OF THE DEVELOPMENT OF LAMINAR BOUNDARY-LAYER INSTABILITIES ALONG A SHARP CONE Final Report, 12 - 15 Feb. 1985
J. C. Donaldson and S. A. Simons Apr. 1985 62 p Sponsored by Air Force
(AD-A159370; AEDC-TSR-85-V16) Avail: NTIS HC A04/MF A01 CSCL 20/4

Measurements of mean-flow and fluctuating-flow parameters were made in the boundary layer on a sharp 7-deg cone in an investigation of the stability of laminar boundary layers. The flow fluctuation measurements were made using hot-wire anemometry techniques. Flow field profiles and model surface conditions were also measured. The testing was performed at a free-stream Mach number of 8 for free-stream Unit-Reynolds numbers of 1.0, 2.0, and 3.0-million per foot. The test equipment and techniques and the data acquisition and reduction procedures are described. Analysis of the hot-wire anemometer data is beyond the scope of this report. GRA

N86-16522# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
SIMULATION OF TURBULENT BOUNDARY LAYER WALL PRESSURE FLUCTUATIONS Final Report, period ending 30 Sep. 1984
R. L. Ash and M. R. Khorrami Aug. 1985 34 p
(Contract N00014-82-K-0639)
(AD-A159400) Avail: NTIS HC A03/MF A01 CSCL 20/4

A Monte Carlo simulation of an unsteady, two-dimensional wall pressure field has been developed. The simulation has been evaluated in terms of the statistical properties measured in a variety of turbulent boundary layer experiments and the results are generally in good agreement. Since identifical pressure histories can be created using simulations, it has been possible to investigate the influence of receiver area (or microphone size) on the statistical measurements of identical pressure histories. Based on these simulations, it was possible to conclude that the root mean square pressure levels increase in a quasi linear manner as the receiver size decreases. The trend is in substantial agreement with the experiments of Bull and Thomas, but the threshold of the diameter effect and the magnitude of the r.m.s. increase may be controlled by flow phenomena that are either ignored or improperly simulated. The power spectra are insensitive to receiver size in the energy containing frequency interval. Two-point correlations first show higher correlations with decreasing receiver size, then show poorer correlations as the receiver size becomes small enough to sense fine scale phenomena. The authors believe this simulation computer program can be valuable in studying the response of complex or non-linear structures to quasi-random wall pressure fields. The ability to adjust resolution and simulated flow conditions arbitrarily make it a flexible tool in the analyzing and designing fluid-structural systems. GRA

N86-16523# Lawrence Livermore National Lab., Calif.
FREE-LAGRANGE METHODS FOR COMPRESSIBLE HYDRODYNAMICS IN TWO SPACE DIMENSIONS
W. E. Crowley 1 Mar. 1985 23 p refs Presented at Free-Lagrangian Methods Conference, Hilton Head Island, S.C., 4 Mar. 1985
(DE85-012946; UCRL-92385; CONF-850139-2) Avail: NTIS HC A02/MF A01

Since 1970 a research and development program in Free-Lagrange methods has been active at Livermore. The initial steps were taken with incompressible flows for simplicity. Since then the effort has been concentrated on compressible flows with shocks in two space dimensions and time. In general, the line integral method has been used to evaluate derivatives and the artificial viscosity method has been used to deal with shocks. Basically, two Free-Lagrange formulations for compressible flows in two space dimensions and time have been tested and both will be described. In method one, all prognostic quantities were node centered and staggered in time. The artificial viscosity was zone centered. One mesh reconnection philosphy was that the mesh should be optimized so that nearest neighbors were connected together. Another was that vertex angles should tend toward equality. In method one, all mesh elements were triangles. In method two, both quadrilateral and triangular mesh elements are permitted. The mesh variables are staggered in space and time as suggested originally by Richtmyer and von Neumann. The mesh reconnection strategy is entirely different in method two. In contrast to the global strategy of nearest neighbors, we now have a more local strategy that reconnects in order to keep the integration time step above a user chosen threshold. An additional strategy reconnects in the vicinity of large relative fluid motions. Mesh reconnection consists of two parts: (1) the tools that permits nodes to be merged and quads to be split into triangles etc. and; (2) the strategy that dictates how and when to use the tools. Both tools and strategies change with time in a continuing effort to expand the capabilities of the method. New ideas are continually being tried and evaluated. The successful ones stay in the code, and in some sense its intelligence increases with time. DOE

N86-16524# Oak Ridge National Lab., Tenn.
GAMMA STIRLING CONFIGURATION AND SIMULTANEOUS PRODUCTION OF SHAFT POWER AND HEAT PUMPING
J. L. Crowley, F. P. Griffin, and C. D. West 1985 23 p Presented at the 20th Intersociety Energy Conversion Engineering Conference, Miami Beach, Fla., 18 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016314; CONF-850808-19) Avail: NTIS HC A02/MF A01

In an ideal gamma configuration Stirling engine, the volume of the cold end of the displacer varies 180(0) out of phase with that at the hot end; therefore, exactly as much heat must be rejected as the hot end absorbs. The power piston, moving with a different phase, produces mechanical energy, so the power piston cylinder must absorb heat for there to be an overall energy balance. In other words, the engine simultaneously produces mechanical power and pumps heat between the two sections of the compression space. Inclusion of a second regenerator, between the cold displacer cylinder and the power piston cylinder, can capture this heat flow; the resulting machine is a heat-actuated heat pump that also produces shaft power. Unlike the duplex Stirling heat pump, the new configuration has only one working space and produces a surplus of shaft power. DOE

N86-16525# Argonne National Lab., Ill.
INTERFACIAL AREA MODELING
M. Ishii 1985 35 p Presented at the International Workshop on Two-Phase Flow Fundamentals, Gaithersburg, Md., 23 Sep. 1985
(Contract W-31-109-eng-38)
(DE85-014960; CONF-8509123-1) Avail: NTIS HC A03/MF A01

The interfacial transfer terms are the most important aspect of the two-fluid formulation modeling. However, there exist considerable difficulties in this area both in terms of experiments and modeling. The first step in the right direction is to consider that the interfacial transfer terms are proportional to the interfacial area concentration and driving force. This approach effectively separates the first-order geometrical effect on the interfacial transfers from the local driving forces. Hence more mechanistic modeling of the interfacial transfer terms becomes possible. In view of the importance of the interfacial area concentration, the available experimental data, measurement methods and modeling are reviewed and new directions are indicated. DOE

N86-16526# New York Univ., New York. Mathematics and Computing Lab.
COMPRESSIBLE RAYLEIGH-TAYLOR INSTABILITY OF SUPERSONIC ACCELERATED SURFACES
C. L. Gardner Jul. 1985 27 p refs
(Contract DE-AC02-76ER-03077)

(DE85-016185; DOE/ER-03077/264) Avail: NTIS HC A03/MF A01

The compressible Rayleigh-Taylor instability of a supersonic accelerated contact discontinuity between two gases is studied by numerically solving the two-dimensional Euler equations. The computed solutions exhibit a complicated set of nonlinear waves comprised of spike and bubble bow shocks, terminal shocks within the spike and bubble, Kelvin-Helmholtz rollup of the spike tip, and contact surface waves. The spike appears to attain a finite growth of aspect ratio approximately equal to 2. The propagation of a supersonic slab jet is also studied numerically, in order to compare and contrast the jet wave structure with that of the supersonic accelerated surface. DOE

N86-16527# Argonne National Lab., Ill.
FLOW INDUCED VIBRATION OF TWO CIRCULAR CYLINDERS IN CROSSFLOW
S. S. Chen 1985 46 p Presented at ASME vibration and Sound Conference, Cincinnati, Ohio, 10 Sep. 1985
(Contract W-31-109-eng-38)
(DE85-006133; CONF-850926-1) Avail: NTIS HC A03/MF A01

The flow field around a pair of rigid circular cylinders is very complex and has been studied extensively. When either one or both cylinders vibrate, the flow field becomes significantly more complicated because of the interaction of ther fluid flow and the cylinder motion. An overview of the problem is presented, including different flow regimes, vortex-excited vibration, fluid elastic instability for two cyclinders in tandem, two cylinders side by side and two cylinders in staggered arrangement. A general formulation to study dynamic response under different conditions is outlined and future research needs are discussed. DOE

N86-16528# Utah Univ., Salt Lake City.
LABORATORY MEASUREMENTS OF A DIRECT-CONTACT HEAT EXCHANGER Final Subcontract Report
R. F. Boehn Jun. 1985 46 p
(Contract DE-AC02-83CH-10093)
(DE85-012146; SERI/STR-252-2678) Avail: NTIS HC A03/MF A01

Evaluations of a 0.62 m (24 in.) diameter direct contact tower heat exchanger have been made. The tower is a test bed designed to evaluate direct contact processes that might be used in a salt stratified solar pond power plant. In the present application, commercial grade normal pentane is boiled while in direct contact with hot water, with the water flowing downward and the pentane flowing upward. Of particular interest was the determination of the flooding limit in the tower. In all cases, a water inlet temperature of 85 C (185 F) was used. The pentane inlet temperature was approximately 30 C (86 F) and it varied somewhat with ambient temperature. Several values of tower operating pressure in the range of 1.2 atm to 3.2 atm were evaluated. Water and pentane flow rates were also varied to find their affect on flooding. In all cases the operating level of the tower was maintained at approximately 3.1 m (10 ft). An initial set of evaluations were made with a sparse egg-crate packing where the flow channels were aligned with the length of the column. Comparisons were then made with a simple spray tower configuration. Correlations of the flooding limits are given. The spray tower configuration showed higher performance before flooding. DOE

N86-16529# Sandia National Labs., Albuquerque, N. Mex.
DERIVATION OF FINITE ELEMENT CONDUCTIVITY AND CAPACITANCE MATRICES FOR 2- AND 3-DIMENSIONAL CONDUCTION HEAT TRANSFER
J. M. Nelsen Jun. 1985 43 p refs
(Contract DE-AC04-76DP-00789)
(DE85-014344; SAND-85-0479; TTC-0545) Avail: NTIS HC A03/MF A01

Current techniques commonly utilized in numerical heat transfer analysis carry imposed capability limitations. For example, finite difference formulated heat transfer analysis generally suffers from geometry restrictions. Similarly, finite element formulated heat transfer analyses typically linearize nonlinear transport mechanisms such as convection and radiation. This report considers the concept of beneficially linking the two methods, with the initial phase of such a hybridization derived in detail. DOE

N86-16530# California Univ., Berkeley. Lawrence Berkeley Lab.
RADIATIVE HEAT PUMPS USING NARROW-BANDGAP SEMICONDUCTORS
P. Berdahl Aug. 1985 12 p Presented at the SPIE International Technical Symposium on Optical and Electro-optical Engineers, San Diego, Calif., 18 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE85-017654; LBL-19174; CONF-850887-34) Avail: NTIS HC A02/MF A01

The Solid State Radiative Heat Pump (SSRHP) concept is introduced. It offers the potential to pump infrared radiation - for heating and cooling - with high second law efficiency. In particular, some of the limitations of Peltier-effect heat pumps can be circumvented. Two approaches for constructing SSRHP devices will be described. In one approach the device is a large-area p-n junction, similar to an ir (light) emitting diode. In the second approach one uses orthogonal electric and magnetic fields to alter equilibrium carrier concentrations of electrons and holes near the crystal surface, altering the ir emission due to electron-hole recombination radiation. This phenomenon is usually termed galvanomagnetic luminescence (GML). Either approach can be used to make radiative heat pumps. Materials suitable for SSRHP devices are narrow-bandgap semiconductors with direct bandgaps in the range of 0.03 to 0.3 eV for room temperature operation. Obvious candidates are InSb, Hg sub (1-x) Cd sub x/Te, and Pb/sub (1-x) Sn/sub x/Te. As a first step in the evaluation of InSb, our laboratory has made absolute spectral measurements of its galvanomagnetic luminescence. These and related measurements in Russia and Japan are discussed. DOE

N86-16531# Sandia National Labs., Albuquerque, N. Mex.
NORIA - A FINITE ELEMENT COMPUTER PROGRAM FOR ANALYZING WATER, VAPOR, AIR, AND ENERGY TRANSPORT IN POROUS MEDIA
N. E. Bixler Aug. 1985 125 p refs
(Contract DE-AC04-76DP-00789)
(DE86-000043; SAND-84-2057) Avail: NTIS HC A06/MF A01

NORIA is a finite element computer program that solves four nonlinear, parabolic, partial differential equations simultaneously. The four equations describe the transport of water, water vapor, air, and energy through partially saturated porous media. The numerical procedure uses the standard Galerkin finite element method to handle spatial discretization of two-dimensional domains with either planar symmetry or axisymmetry. Time integration is performed by a third-order predictor-corrector scheme that uses error estimates to automatically adjust time-step size so as to maintain uniform local time truncation error throughout the calculation. Thus, the user is not required to select time-step size except at the first time step. Nearly all material properties, such as permeability, can either be set to constant values or can be defined as functions of the dependent and independent variables by user-supplied subroutines. The gas phase is taken to be ideal. This report is intended primarily as a user's manual but also includes discussions of the theory of two-phase transport in porous media and the numerical procedure used in NORIA. DOE

N86-16532# Sandia National Labs., Albuquerque, N. Mex.
FINITE ELEMENT ANALYSIS OF AXISYMMETRIC OSCILLATIONS OF SESSILE LIQUID DROPS
N. E. Bixler and R. E. Benner 1985 13 p refs Presented at the 4th International Conference on Numerical Methods in Laminar and Turbulent Flow, Swansea, Engl., 8 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-010089; SAND-84-2184C; CONF-850745-10) Avail: NTIS HC A02/MF A01

Inviscid oscillations of sessile liquid drops are simulated by the Galerkin finite element method in conjunction with the time integrator proposed by Gresho, et al. Simulations are of drops in spherical containers which are subjected to imposed oscillations

of specified frequency and amplitude. Five equations govern drop response: (1) Laplace's equation for velocity potential within the drop; (2) a kinematic condition at the free surface; (3) a Bernoulli equation augmented to include gravity and capillary pressure at the free surface; (4) a kinematic condition at the solid surface; and (5) either a condition for fixed contact line or fixed contact angle. Each of these equations is modified to account for an accelerating frame of reference which moves the container. Normalized drop volume, contact angle, and gravitational Bond number are dimensionless parameters which control drop response to an imposed oscillation. Given a set of fluid properties, such as those for mercury, gravitational Bond number is uniquely defined by the container radius. Resonant frequencies and mode interaction are detected by Fourier analysis of a transient signal, such as free surface position at the pole of a spherical coordinate system. Results, especially resonant frequencies, are found to depend strongly on contact line condition. Calculation of resonant frequencies by eigenanalysis with Stewart's method is also discussed. DOE

N86-16533# Argonne National Lab., Ill.
COMPARISON OF HEAT TRANSFER IN SOLAR COLLECTORS WITH HEAT PIPE VERSUS FLOW THROUGH ABSORBERS
J. R. Hull 1985 33 p Presented at the American Society of Mechanical Engineers Winter Annual Meeting, Miami, Fla., 17 Nov. 1985
(Contract W-31-109-eng-38)
(DE85-012121; CONF-851125-2) Avail: NTIS HC A03/MF A01

Analysis of heat transfer in solar collectors with heat pipe absorbers is compared to that for collectors with flow through absorbers. Both pumped and thermosiphon systems that produce hot water or other heated fluids are discussed. In these applications the heat pipe absorber suffers a heat transfer penalty compared with the flow through absorber, but in many cases the penalty can be minimized by proper design at the heat pipe condenser and system manifold. When the solar collector is used to drive an absorption chiller, the heat pipe absorber has better heat transfer characteristics than the flow through absorber. DOE

N86-16534# Oak Ridge National Lab., Tenn.
DESIGN OF AN ADVANCED ABSORPTION HEAT PUMP FOR MINIMUM PAYBACK PERIOD
M. R. Patterson and H. Perez-Blanco 1985 29 p refs Presented at the American Society of Mechanical Engineers Winter Annual Meeting, Miami, Fla., 17 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE85-013993; CONF-851125-7) Avail: NTIS HC A03/MF A01

Absorption heat pumps of the type analyzed here provide process heat from waste heat. A simulation model with optimization capability is now operational for an advanced sodium hydroxide-water absorption heat pump with a regenerative loop. In this type of heat pump, increasing the area of the heat exchangers increases the dollar value of the process heat output, but it also increases the capital cost. The designer is then faced with the decision of how to allocate the heat exchanger area among the several heat pump components for optimal economic benefits. The optimization feature of the program allows the user to minimize the payback period for recovery of the capital investment in the heat pump. The computer program employs proprietary software for the optimization. The program is relatively short, about 400 lines of FORTRAN, and can readily be used with different optimization subroutines if desired. Results from the model indicate that the payback period is short, about 1 to 2 years for the standard case. These predictions make this regenerative-loop heat pump an attractive cycle for further investigation. DOE

N86-16535# Babcock and Wilcox Co., Lynchburg, Va.
THERMAL AND FLUID DESIGN OF A CERAMIC BAYONET TUBE HEAT EXCHANGER FOR HIGH-TEMPERATURE WASTE HEAT RECOVERY
M. Luu and K. W. Grant 1985 41 p refs Presented at the Industrial Heat Exchanger Technology Symposium, Pittsburgh, Pa., 6 Nov. 1985
(Contract DE-FC07-81ID-12296)
(DE85-017033; CONF-851106-1) Avail: NTIS HC A03/MF A01

A new ceramic recuperator has been developed to recover waste heat from high-temperature flue gas up to 2250F. The recuperator is comprised of a number of ceramic bayonet elements which are assemblies of two concentric tubes. The recuperator is a cross counterflow heat exchanger with both the inlet and the outlet plenums located at one end of the elements. As a result, the freely expanding elements greatly simplify the structure of the heat exchanger and eliminate thermal stress and stress related corrosion problems. Moreover, the relatively wide spacing between the elements would make them less likely plugged up by dirty flue gas. Thermal and fluid design of the recuperator requires an unconventional approach. The design of the recuperator and its major components is outlined here. Results from a prototype test indicated that the recuperator would function as predicted. The ceramic recuperator can effectively recover waste heat from high temperature flue gas. DOE

N86-16536# Argonne National Lab., Ill.
TWO-PHASE GAS BUBBLE-LIQUID BOUNDARY LAYER FLOW ALONG VERTICAL AND INCLINED SURFACES
F. B. Cheung and M. Epstein 1985 8 p Presented at the 3rd International Meeting on Reactor Thermal Hydraulics, Newport, R.I., 15 Oct. 1985 Prepared in cooperation with Pennsylvania State Univ., University Park and Fauske and Associates, Inc., Burr Ridge, Ill.
(Contract W-31-109-eng-38)
(DE85-018462; CONF-851007-11) Avail: NTIS HC A02/MF A01

The behavior of a two-phase gas bubble-liquid boundary layer along vertical and inclined porous surfaces with uniform gas injection is investigated experimentally and analytically. Using argon gas and water as the working fluids, a photographical study of the two-phase boundary layer flow has been performed for various angles of inclination ranging from 45 deg to 135 deg and gas injection rates ranging from 0.01 to 0.1 m/s. An integral method has been employed to solve the system of equations governing the two-phase motion. The effects of the gas injection rate and the angle of inclination on the growth of the boundary layer have been determined. The predicted boundary layer thickness is found to be in good agreement with the experimental results. The calculated axial liquid velocity and the void fraction in the two-phase region are also presented along with the observed flow behavior. DOE

N86-16537# Centre Technique des Industries Mecaniques, Senlis (France).
PARAMETRIC STUDY OF HOLES FOR ENERGY DISSIPATION IN NOZZLE DISCHARGE Final Report [ETUDE PARAMETRIQUE DES DETENDEURS A TROUS]
(CETIM-101-830) Avail: NTIS HC A03/MF A01

The optimization of a patent to determine the minimum secondary subsonic flow necessary to stabilize the main nozzle supersonic flow and to diminish the mixing zone is explored. The problem is of interest to the manufacturers of large turbines. The device is described. The flow is analyzed, concluding that it is possible to quantify the minimum subsonic flow to be injected to avoid violent shock in supersonic discharge. The results agree with experiment. Author (ESA)

N86-16538# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
DRAG REDUCTION THROUGH BOUNDARY LAYER CONTROL: A REPORT ON EUROMECH 181
A. Bertelrud, G. Drougge, and M. T. Landahl 29 May 1985 22 p refs Colloquium held in Saltsjoebaden, Sweden, 29-31 Aug. 1984
(Contract STU-84-4563)
(FFA-TN-1984-60) Avail: NTIS HC A02/MF A01

Skin friction reduction by boundary layer control was discussed. Delay of transition; turbulent drag reduction; and modification of shock wave/boundary layer interaction are considered. Author (ESA)

N86-16539# Rolls-Royce Ltd., Derby (England). Theoretical Science Group.
PREDICTION OF FLOW IN A ROTATING CAVITY WITH RADIAL OUTFLOW USING A MIXING LENGTH TURBULENCE MODEL
John W. Chew 23 Jul. 1985 13 p refs
(PNR-90290) Avail: NTIS HC A02/MF A01

Numerical solutions of the elliptic equations for turbulent flow in the cavity formed between two rotating disks with a radial outflow of coolant are presented. The results are compared with experimental data, predictions from the K-e model, and an integral solution. It is concluded that the mixing length model can be used for engineering design calculations. The applications are limited by slow convergence of the iterative solution method at high rotational speeds. Author (ESA)

N86-16540# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
SUBCHANNEL ANALYSIS WITH FLOW BLOCKAGES
L. Sabotinov May 1985 28 p refs
(PDR/CFDU/IC/22) Avail: NTIS HC A03/MF A01

The steady state single-phase three-dimensional flow in the rod bundle geometry of a nuclear pressurized water reactor was calculated with the PHOENICS 84 program. Flow blockages, which may occur under accident conditions, are simulated. Results show that PHOENICS-84 can be applied to calculation of the three-dimensional fields of velocities in fuel rod bundles containing complete flow blockages in cells. The code can treat recirculation zones. Author (ESA)

N86-16541# Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.
ON TWO-DIMENSIONAL SLOW VISCOUS FLOWS PAST OBSTACLES IN A HALF-PLANE
T. M. Fischer, G. C. Hsiao (Delaware Univ.), and W. L. Wendland (DFVLR, Goettingen, West Germany) Mar. 1985 15 p refs Submitted for publication
(Preprint-883) Avail: NTIS HC A02/MF A01

It is shown that, for a given cylinder with arbitrary cross section moving in the viscous, incompressible fluid parallel to a plane wall, the stationary linear hydrodynamic equations have a unique solution. The nonlinearity of the full Navier-Stokes problem is approximated by two terms in the asymptotic expansion for the solution of this problem with respect to small Reynolds numbers. The results extend those obtained for the three-dimensional case. Author (ESA)

N86-16542# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THE EVOLUTION OF SIMPLE VORTEX SYSTEMS IN LIQUID HELIUM 2
W. Fiszdon (Polish Academy of Sciences, Warsaw), W. Poppe, and D. W. Schmidt Jan. 1985 62 p refs
(MPIS-1/1985; ISSN-0436-1199) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18

The evolution of the superfluid and normal vorticity distribution in liquid helium 2 in the axisymmetric case and nonaxisymmetric configurations was analyzed. Analytical calculations for the axisymmetric case and numerical analysis show the existence of at least two characteristic times, one for the growth or decay of the extrema of the distributions, the other corresponding to the spreading and/or the displacements of the extrema or centers of gravity of the vorticity distributions. This leads to different vorticity distribution topographies depending on their initial configurations. Author (ESA)

N86-16543# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics.
INITIAL FLOW DEVELOPMENT DUE TO MARANGONI CONVECTION IN A MASS TRANSFER SYSTEM
H. A. Dijkstra and A. I. vandeVooren Sep. 1984 29 p refs
(TW-265) Avail: NTIS HC A03/MF A01

A linear stability analysis is used to investigate the onset of convection in a mass transfer system due to surface tension differences. Instead of a steady linear concentration distribution as basic state, a detailed analysis of the mass transfer due to diffusion in the initially motionless flow is performed. A time dependent basic concentration distribution is obtained. The critical wave number, at neutral stability, and the preferred wave number, with largest growth factor, are time dependent and decrease in time. Author (ESA)

N86-16544# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
PERFORMANCE EVALUATION OF EXPLICIT SHALLOW-WATER EQUATIONS SOLVER ON THE CYBER 205
F. W. Wubs Jun. 1985 15 p refs Submitted for publication Sponsored by Netherlands Foundation for Technical Research and Netherlands Organization for the Advancement of Pure Research
(CWI-NM-R8511; B8569858) Avail: NTIS HC A02/MF A01

The performance of an explicit method and an ADI method for the shallow-water equations is compared on a Cyber 205. A technique which stabilizes the explicit method in such a way that any desired time step is possible without the development of instabilities is discussed. Comparing the codes for two test models, the explicit methods are attractive on the Cyber 205. Proposals for the handling of irregular geometries are made. Author (ESA)

N86-16545# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
GENERALIZED APPROXIMATION METHODS FOR THE CALCULATION OF INCOMPRESSIBLE LAMINAR BOUNDARY LAYERS, PART 1 [GEGENERALISEERDE BENADERINGSMETHODEN VOOR DE BEREKENING VAN INCOMPRESSIBLE LAMINAIRE GRENSLAGEN, DEEL 1]
J. A. Zaat 1983 60 p refs In DUTCH 2 Vol.
(Rept-83-14-Pt-1) Avail: NTIS HC A04/MF A01

Two-dimensional incompressible laminar boundary layer flows are calculated using generalized approximation methods. The methods calculate the variable velocity profile coefficients of laminar incompressible boundary layers using a system of differential equations, the von Karman momentum equation, and/or the Wieghardt energy equation, together with boundary conditions at the wall. The generalized methods remove the discontinuity in the profile coefficients and substantially improve the boundary layer calculations. The methods are applied to obtain similarity solutions of two-dimensional boundary layer flows; they do not seem to be applicable in the transition domain between accelerated and decelerated flow. The computer program which calculates the similarity boundary layer profiles is given. Author (ESA)

N86-16546# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
GENERALIZED APPROXIMATION METHODS FOR THE CALCULATION OF INCOMPRESSIBLE LAMINAR BOUNDARY LAYERS, PART 2 [GEGENERALISEERDE BENADERINGSMETHODEN VOOR DE BEREKENING VAN INCOMPRESSIBELE LAMINAIRE GRENSLAGEN, DEEL 2]
J. A. Zaat 1983 60 p In DUTCH 2 Vol.
(Rept-83-15-Pt-2) Avail: NTIS HC A04/MF A01

Laminar boundary layer calculations are performed using the von Karman momentum equation and the Wieghardt energy equation and the first five, then the first seven boundary conditions at the wall. The theory of this calculations is explained. The calculation of the stretch factor, shear stress, and physical quantities are presented. The use of a step in the calculation procedure is described. The results show very good agreement with exactly calculated values in the domain of the accelerated as well as the decelerated flow. The ALGOL calculation programs are given. Author (ESA)

N86-16547# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
A COMPARISON OF SEVERAL FINITE ELEMENT METHODS TO SOLVE STATIONARY NAVIER-STOKES EQUATIONS
A. Segal 1983 19 p refs
(Rept-83-19) Avail: NTIS HC A02/MF A01

The integrated solution approach, the penalty function approach, and the solenoidal approach for the finite element solution of the stationary Navier Stokes are compared. It is shown that the penalty function approach and the solenoidal approach compare favorably to the integrated solution method. For fine meshes the solenoidal approach appears to be the cheapest method. Author (ESA)

N86-16548# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
TRANSVERSE DISPERSION FROM AN ORIGINALLY SHARP FRESH-SALT INTERFACE CAUSED BY SHEAR FLOW
G. deJosselindeJong and C. J. vanDuyn 1984 50 p refs
(Rept-84-44) Avail: NTIS HC A03/MF A01

Motions of fluids of different densities in an aquifer were modeled. An exact solution for the development of the brackish region from an inclined, initially sharp interface between fresh and salt water was derived. Dispersion is described by reducing the coupled system consisting of equations describing the specific discharge rotations (which produce shear flow) due to the gradual density variations, and the dispersion, caused by the specific discharge distribution, to a system of ordinary differential equations of diffusion type. Author (ESA)

N86-16430# Joint Publications Research Service, Arlington, Va.
AUTOMATIC GATHERING, PROCESSING OF MULTIPOINT PRESSURE DATA ANALYZED
Zhou Xinghua *In its* China Report: Science and Technology (JPRS-CST-85-039) 13 Nov. 1985 p 35-43 refs Transl. into ENGLISH from Tianjin Daxue Xuebao (Tianjin, China), no. 2, Dec. 1984 p 115-120 (For primary document see N86-16429 07-31)
Avail: NTIS HC A07/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-16549 Idaho Univ., Moscow.
SYSTEM THEORETIC MODELING OF HIGH-DENSITY DIGITAL MAGNETIC RECORDING Ph.D. Thesis
Richard Boyd Wells 1985 232 p
Avail: Univ. Microfilms Order No. DA8518199

This work is a system theoretic approach to modeling the recording process in high-density, digital, longitudinal magnetic recording systems. Observable properties of the system are discussed. The practice of inferential measurement of track average magnetization using phenomenological forms is discussed. It is shown that unless the total effective separation distance between head and medium is known, there will always exist an uncertainty in the length of the magnetic transition when inferential determinations of it are made. By using direct observations of the magnetic transition and a new measurement technique involving blind deconvolution it is possible to determine the depth of the dead layer in ferrite heads. The measurement of efficiency in ferrite heads is also discussed. It is shown that head efficiency may be determined from vector impedance measurements of the head if the permeability vs. frequency characteristics of the head material are known. Head efficiency measurements prove that head efficiency is relatively insensitive to frequency out to at least 10 MHz using commercial Mn-Zn ferrites. Dissert. Abstr.

N86-16550*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
ADVANCED MOISTURE AND TEMPERATURE SOUNDER (AMTS) STUDY Final Report
L. D. Kaplan, R. G. Isaacs, R. D. Worsham, and G. DeBlonde Jun. 1985 80 p refs
(Contract NAS5-27629)
(NASA-CR-177833; NAS 1.26:177833) Avail: NTIS HC A05/MF A01 CSCL 14B

Retrieval of tropospheric humidity profiles from satellite-based upwelling radiances are shown to be improved by using physical methods for obtaining first-guess profiles as well as for inverting the radiative transfer equation by relaxation. The first guess is based on an empirically verified hypothesis, from theoretical considerations, that the brightness temperature corresponding to the radiance should be approximately equal to the actual temperatue at a channel-invariant optical depth provided that the surface and stratospheric contributions to the radiance are small. Even greater improvement of retrieved humidity profiles can be accomplished by increasing the number of channels used and by selecting their spectral location and bandpass to obtain sharper independent weighting functions. For example, the AMTS system, with high resolution water channels at 1650, 1700, 1839, 1850 and 1930 cm, is shown to be capable of reducing the retrieved water vapor errors in 200 mb thick layers by a factor of two or three relative to the HIRS-2 system errors. Expected AMTS errors in tropical layer water content are particularly low, less than 20% at all levels, and of the order of 10% or less in the middle troposphere. B.W.

N86-16551*# Baylor Coll. of Medicine, Houston, Tex. Dept. of Medicine.
DEVELOPMENT OF TUNGSTEN-TANTALUM GENERATOR Final Report
Adrian LeBlanc, John Babich, and Satish G. Jhingran 1985 120 p refs
(Contract NAS9-16818)
(NASA-CR-171905; NAS 1.26:171905) Avail: NTIS HC A06/MF A01 CSCL 14E

The purpose of this project was to develop a useable tungsten (W)/tantalum (Ta) generator. Ta-178 is formed following the decay of its parent, W-178 (half-life: 21.7d) and has a half life of 9.3 minutes in turn yielding stable Hf-178. The decay of the parent isotope (W-178) occurs entirely by electron capture to the 9.3 minute Ta-178 state, without feeding the high spin Ta-178 isomer (half life 2.2 hours). In Ta-178 decay, 99.2% of the disintegrations proceed by electron capture and 0.18% by positron emission. Electron capture results in a 61.2% branch to the ground state of Hf-178 and 33.7% to the first excited state at 93 1KeV. The most prominent features of the radionuclide's energy spectrum are the hafnium characteristic radiation peaks with energies between 54.6 and 65.0 KeV. The radiation exposure dose of Ta-118 was calculated to be approximately one-twentieth that of Tc-99m on a per millicurie basis. A twenty-fold reduction in radiation exposure from Ta-178 compared with Tc-99m means that the usual administered dose can be increased three or four times, greatly increasing statistical accuracy while reducing radiation exposure by a factor of five. R.J.F.

N86-16552*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EARTH RADIATION BUDGET EXPERIMENT (ERBE) SCANNER INSTRUMENT ANOMALY INVESTIGATION
N. D. Watson, J. B. Miller, L. V. Taylor, J. B. Lovell, J. W. Cox, J. C. Fedors, L. P. Kopia, R. M. Holloway, and O. H. Bradley Oct. 1985 87 p
(NASA-TM-87636; NAS 1.15:87636) Avail: NTIS HC A05/MF A01 CSCL 13I

The results of an ad-hoc committee investigation of in-Earth orbit operational anomalies noted on two identical Earth Radiation Budget Experiment (ERBE) Scanner instruments on two different spacecraft busses is presented. The anomalies are attributed to the bearings and the lubrication scheme for the bearings. A detailed discussion of the pertinent instrument operations, the approach of the investigation team and the current status of the instruments now in Earth orbit is included. The team considered operational changes for these instruments, rework possibilities for the one

instrument which is waiting to be launched, and preferable lubrication considerations for specific space operational requirements similar to those for the ERBE scanner bearings. Author

N86-16553*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IMAGE PROCESSING OF AERODYNAMIC DATA
Nettie D. Faulcon Dec. 1985 15 p refs
(NASA-TM-87629; NAS 1.15:87629) Avail: NTIS HC A02/MF A01 CSCL 14B

The use of digital image processing techniques in analyzing and evaluating aerodynamic data is discussed. An image processing system that converts images derived from digital data or from transparent film into black and white, full color, or false color pictures is described. Applications to black and white images of a model wing with a NACA 64-210 section in simulated rain and to computed low properties for transonic flow past a NACA 0012 airfoil are presented. Image processing techniques are used to visualize the variations of water film thicknesses on the wing model and to illustrate the contours of computed Mach numbers for the flow past the NACA 0012 airfoil. Since the computed data for the NACA 0012 airfoil are available only at discrete spatial locations, an interpolation method is used to provide values of the Mach number over the entire field. Author

N86-16554# California Univ., Berkeley. Lawrence Berkeley Lab.
AFTERPULSE TIME SPECTRA OF HIGH-SPEED PHOTON DETECTORS
B. Leskovar 10 Jan. 1985 13 p refs Presented at the 7th International Congress and Exhibition on Laser Opto-Electronics, Munich, South Germany, 1 Jul. 1985
(Contract DE-AC03-76SF-00098)
(DE85-016631; LBL-18909; CONF-850715-1) Avail: NTIS HC A02/MF A01

Recent progress of understanding of the afterpulse time spectra of high-speed photon detectors using photoemission and secondary emission processes is reviewed and summarized. Furthermore, the afterpulse time spectra of high-gain conventionally designed and microchannel plate photon detectors was investigated. Specifically, the devices studied included RCA 8850, RCA 8854 and ITT F 4129g photomultipliers. Descriptions are given of the measuring techniques. DOE

N86-16555# Los Alamos National Lab., N. Mex.
FAST FRAMING CAMERA WITH INDEPENDENT FRAME ADJUSTMENTS
G. A. Kyrala, J. S. McGurn, J. Calligan, and J. Pallone 1985 6 p Presented at the High Speed Photography, Videography, Photonics 3, San Diego, Calif., 18 Aug. 1985 Prepared in cooperation with Edgerton, Germeshausen and Grier, Inc., Los Alamos, N. Mex.
(Contract W-7405-eng-36)
(DE85-015751; LA-UR-85-2570; CONF-850899-1) Avail: NTIS HC A02/MF A01

Researchers designed, built and tested a fast framing camera that works in the visible and short infrared region of the spectrum, from 300 nm to 850 nm. The camera has four separate channels. Each framing channel has its own individual trigger input and individually adjustable framing gate width. Each channel is spatially separate from the other channels as well, thus allowing for complete independence among the four channels. The output from the four channels in the camera is recorded on one piece of 4 in. by 5 in. sheet of film. Each channel has a circular recording format with a useful diameter of 18 mm. The channels are positioned on the corners of a square with a center to center spacing of 4.45 cm (1.75 in.). The camera utilizes commercially available gated intensified microchannel-plate tubes. The camera contains its own power supply and gating circuits. It required four gating inputs (12 volts). The electronics occupy a volume of 27 cm x 33 cm x 14 cm. The framing part occupies a volume of 21 cm x 25 cm x 5 cm. Characteristics of the camera, such as framing times, spatial modulation transfer functions, gate delay, and uniformity were studied utilizing a 35 picosecond long blue light pulse generated by a nitrogen-pumped dye-laser system. A pulsed semiconductor laser at 820 nm was used as well as for the setup. DOE

N86-16556# Sandia Labs., Albuquerque, N. Mex.
HIGH SPEED MULTI-CHANNEL DATA RECORDER TO REPLACE OSCILLOSCOPE DATA ACQUISITION SYSTEMS
G. J. Lockwood, J. Chang, W. F. Filter, C. O. Landron, D. J. Muron, B. T. Neyer, and L. E. Ruggles 1985 21 p Presented at SPIC International Technical Symposium on Optical and Electro-Optical Engineers, San Diego, Calif., 18 Aug. 1985
(Contract DE-AC04-76DP-00789)
(DE85-015158; SAND-85-0362C; CONF-850887-6) Avail: NTIS HC A02/MF A01

We have developed and tested a photonic high speed analog data recording system that, when compared with conventional oscilloscope-based systems, offers greater economy, higher bandwidth, electrical isolation, and compactness. The basis of this approach is to record analog photonic signals rather than analog electrical signals. A key component is a prototype high speed multichannel data recorder (HSMCDR). It uses a picosecond streak camera with a digital readout to record multiple fiber-optic data channels, and a dedicated microcomputer to reduce and process that data. To record signals from analog electrical sensors, laser diode transmitters provide an interface to the HSMCDR. Interactive software written for the HSMCDR separates, calibrates, and plots up to 20 waveforms in the customary amplitude versus time format. The HSMCDR, its performance, applications in pulsed power experiments, and its impact in diagnostic technology is described. DOE

N86-16557# Los Alamos National Lab., N. Mex.
STATUS OF THE LOS ALAMOS ANGER CAMERA
P. A. Seeger and M. J. Nutter 1985 8 p refs Presented at the 8th Meeting of International Collaboration on Advanced Neutron Sources, Oxford, England, 7 Jul. 1985
(Contract W-7405-eng-36)
(DE85-015666; LA-UR-85-2402; CONF-850762-2) Avail: NTIS HC A02/MF A01

Results of preliminary tests of the neutron Anger camera being developed at Los Alamos are presented. This detector uses a unique encoding scheme involving parallel processing of multiple receptive fields. Design goals have not yet been met, but the results are very encouraging and improvements in the test procedures are expected to show that the detector will be ready for use on a small-angle scattering instrument next year. DOE

N86-16558# Los Alamos National Lab., N. Mex.
VISAR: INTERFEROMETER QUADRATURE SIGNAL RECORDING BY ELECTRONIC STREAK CAMERA
W. F. Hemsing 1985 8 p refs Presented at the 8th International Symposium on Detonation, Albuquerque, N. Mex., 15 Jul. 1985
(Contract W-7405-eng-36)
(DE85-015701; LA-UR-85-2510; CONF-850706-30) Avail: NTIS HC A02/MF A01

This short paper describes a demonstration to record the four quadrature signals from a push-pull VISAR velocity interferometer using an electronic streak camera. Optical fibers were used to transmit the interferometer outputs to the camera photocathode. Brightness variations of these signals were recorded on film during the experiment. Velocity information was later recovered from this record to give a continuous velocity history. Anticipated advantages over previous methods are increased time resolution, the ability to record multiple velocities simultaneously and greater dynamic range. DOE

N86-16559# Department of Energy, Washington, D. C.
MULTIPLE CHANNEL OPTICAL DATA ACQUISITION SYSTEM Patent Application
G. E. Fasching (DOE, Morgantown, W. Va.) and D. R. Goff, inventors (to DOE) (DOE, Morgantown, W. Va.) Filed 22 Feb. 1985 28 p
(DE85-017761; US-Patent-Appl-SN-704115) Avail: NTIS HC A03/MF A01

A multiple channel optical data acquisition system is provided in which a plurality of remote sensors monitoring specific process variable are interrogated by means of a single optical fiber connecting the remote station/sensors to a base station. The remote station/sensors derive all power from light transmitted through the fiber from the base station. Each station/sensor is individually accessed by means of a light modulated address code sent over the fiber. The remote station/sensors use a single light emitting diode to both send and receive light signals to communicate with the base station and provide power for the remote station. The system described can power at least 100 remote station/sensors over an optical fiber one mile in length. DOE

N86-16560# Department of Energy, Washington, D. C.
ORGANIC METAL NEUTRON DETECTOR Patent Application
M. A. Butler (Sandia National Labs., Albuquerque, N. Mex.) and D. S. Ginley, inventors (to DOE) (Sandia National Labs., Albuquerque, N. Mex.) Filed 21 Nov. 1984 18 p
(Contract DE-AC04-76DP-00789)
(DE85-017773; US-Patent-Appl-SN-673969) Avail: NTIS HC A02/MF A01

A device is described for detection of neutrons. It comprises as active neutron sensing element, a conductive organic polymer having an electrical conductivity and a cross-section for said neutrons whereby a detectable change in conductivity is caused by impingement of said neutrons on the conductive organic polymer. It is responsive to a property of said polymer which is altered by impingement of said neutrons on the polymer; and means for associating a change in said alterable property with the presence of neutrons at the location of said device. DOE

N86-16561# Department of Energy, Washington, D. C.
IN-LINE BEAM CURRENT MONITOR Patent Application
C. A. Ekdahl, Jr. and C. A. Frost, inventors (to DOE) Filed 13 Nov. 1984 15 p
(Contract DE-AC04-76DP-00789)
(DE85-017767; US-Patent-Appl-SN-670777) Avail: NTIS HC A02/MF A01

An intense relativistic electron beam current monitor for a gas neutralized beam transport line includes a first foil for conducting plasma current to the wall where it is measured as it traverses an inductive loop formed by a cavity in the wall. An insulator foil separates the first foil from a second conducting foil which returns the current to the plasma environment. DOE

N86-16562# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
MODELS OF SIMPLE ULTRASONIC TRANSDUCERS [ENKELE MODELLEN VAN EENVOUDIGE ULTRASOON TRANSDUCENTEN]
H. F. M. Corstens 1984 42 p refs In DUTCH
(Rept-84-47) Avail: NTIS HC A03/MF A01

A mathematical description of the piezoelectric layer in a transducer was deduced, using the classical method of Mason. The mathematical Mason model is explained, and the resulting equivalent electrical circuits (lumped networks) of Mason for the transducer acting as emitter and as receiver are constructed. It is shown that a Krimboltz-Leedom-Matthaei scheme and a Mason scheme of a piezoelectric layer are mathematically equivalent in the case of even excitation. The transfer functions of the transducer, without adapting layers, are separately determined: as emitter and as receiver of an acoustic signal. The frequency response is numerically calculated for the combination of emitter and receiver, neglecting the damping of the acoustic signal in the transmission medium. Author (ESA)

N86-16658# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DESIGN AND FIELD EXPERIENCE WITH THE WES 10 PERCENT BAR AIRBLAST AND SOIL STRESS GAGE
Charles E. Joachim and Charles R. Welch *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 135-147 (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/2

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-16563*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PERFORMANCE TEST OF LASER VELOCIMETER SYSTEM FOR THE LANGLEY 16-FOOT TRANSONIC TUNNEL
James F. Meyers, William W. Hunter, Jr., David E. Reubush, Cecil E. Nichols, Jr., Timothy E. Hepner (Army Aviation Systems Command, Hampton, Va.), and Joseph W. Lee Dec. 1985 38 p refs
(DA Proj. 1L1-61102-AH-45)
(NASA-TP-2502; L-15940; NAS 1.60:2502; AVSCOM-TR-85-B-4)
Avail: NTIS HC A03/MF A01 CSCL 20E

An investigation in the Langley 16-Foot Transonic Tunnel has been conducted in which a laser velocimeter was used to measure free-stream velocities from Mach 0.1 to 1.0 and the flow velocities along the stagnating streamline of a hemisphere-cylinder model at Mach 0.8 and 1.0. The flow velocity was also measured at Mach 1.0 along the line 0.533 model diameters below the model. These tests determined the performance characteristics of the dedicated two-component laser velocimeter at flow velocities up to Mach 1.0 and the effects of the wind tunnel environment on the particle-generating system and on the resulting size of the generated particles. To determine these characteristics, the measured particle velocities along the stagnating streamline at the two Mach numbers were compared with the theoretically predicted gas and particle velocities calculated using a transonic potential flow method. Through this comparison the mean detectable particle size (2.1 micron) along with the standard deviation of the detectable particles (0.76 micron) was determined; thus the performance characteristics of the laser velocimeter were established. Author

N86-16564# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif. Centrifuge Div.
APPLICATIONS OF PULSED-LASER TECHNIQUES AND THERMOGRAPHIC PHOSPHORS TO DYNAMIC THERMOMETRY OF ROTATING SURFACES
M. R. Cates, S. W. Allison, B. R. Marshall, L. A. Franks, T. J. Davies, M. A. Nelson, and B. W. Noel (Los Alamos National Lab., N. Mex.) Mar. 1985 21 p
(Contract DE-AC05-840R-21400)
(DE85-000403; E/TS-11-504) Avail: NTIS HC A02/MF A01

Stimulating fluorescence by synchronous application of pulsed ultraviolet laser light is used to measure surface temperatures of rotating objects. The temperature dependence of the lifetime of selected emission lines from a phosphor bonded to the surface provides temperature resolution in the room temperature range of about 0.3 deg C. The experimental technique includes fiber optics transfer of stimulating and signal light, timing circuitry, photomultiplier electronics, and waveform processing. DOE

N86-16565# Department of Energy, Washington, D. C.
PREDICTING THRESHOLD AND LOCATION OF LASER DAMAGE ON OPTICAL SURFACES Patent Application
W. Siekhaus, inventor (to DOE) (Lawrence Livermore National Lab., Calif.) Filed 4 Feb. 1985 28 p
(Contract W-7405-eng-48)
(DE85-017793; US-Patent-Appl-SN-697828) Avail: NTIS HC A03/MF A01

An apparatus is disclosed which is useful in the prediction of the damage threshold of various optical devices, the location of weak spots on such devices and the location, identification, and elimination of optical surface impurities. The apparatus comprises a focused and pulsed laser, a photo electric detector/imaging

means, and a timer. The weak spots emit photoelectrons when subjected to laser intensities that are less than the intensity actually required to produce the damage. The weak spots may be eliminated by sustained exposure to the laser beam. DOE

N86-16566# Los Alamos National Lab., N. Mex.
GALLIUM ARSENIDE PHOTOCATHODE FOR THE FREE ELECTRON LASER
S. C. Stotlar, R. W. Springer, B. Sherwood, and R. Cordi 1985 11 p refs Presented at the Southwest Conference on Optics, Albuquerque, N. Mex., 4 Mar. 1985
(Contract W-7405-eng-36)
(DE85-017557; LA-UR-85-2879; CONF-850345-32) Avail: NTIS HC A02/MF A01

The efforts of the FEL source have been concentrated on cesiated GaAs(100) wafers. These crystals have shown photoyield of < .1 to 9% quantum efficiency with the cesium and oxygen treatment. The work function and coverage curves exhibit the same properties as measured in the literature. The use of Auger Electron Spectroscopy and X-ray Photoelectron Spectroscopy have been instrumental in determining the surface cleanliness and the surface oxidation states. The sputtered surfaces have been investigated as a function of rare gas mass and sputter ion voltage, giving similar results to earlier literature values. Temperature annealing appears to be critical after sputter cleaning in achieving any significant photoyield. Contacts of Ag-Mn and Ni-Si have been deposited, heated, and analyzed using Auger Depth Profiling techniques. DOE

N86-16567# Los Alamos National Lab., N. Mex.
NUCLEAR STRUCTURE CONSIDERATIONS FOR GAMMA-RAY LASERS
D. Strottman, E. D. Arthur, and D. G. Madland 1985 23 p Presented at the Conference of IDA on Workshop for Gamma-Ray Lasers, Washington, D.C., May 1985
(Contract W-7405-eng-36)
(DE85-015737; LA-UR-85-2701; CONF-8505174-2) Avail: NTIS HC A02/MF A01

Initial results are presented in the investigation of the nuclear physics issues of gamma-ray lasers. These include the questions of what is known from existing experimental data, where does one optimally search for nuclei displaying simultaneously both closely lying levels and nuclear isomerism, and which theoretical models does one employ for systematic searches for candidate nuclei and for calculation of detailed candidate level properties. These three questions are addressed in the present paper. DOE

N86-16568# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
SELF-CONSISTENT KINETIC DESCRIPTION OF THE FREE ELECTRON LASER INSTABILITY IN A PLANAR MAGNETIC WIGGLER
R. C. Davidson and J. S. Wurtele May 1985 65 p
(Contract DE-AC02-78ET-51013)
(DE85-014139; MIT/PFC/JA-85-17) Avail: NTIS HC A04/MF A01

The linearized Vlasov-Maxwell equations are used to investigate detailed free electron laser (FEL) stability properties for a tenuous relativistic electron beam propagating in the z-direction through the planar wiggler magnetic field. The theoretical model neglects longitudinal perturbations and transverse spatial variations. For low or moderate electron energy, there can be a sizeable modulation of beam equilibrium properties by the wiggler field and a concomitant coupling of the k'th Fourier component of the wave to the components k + or - 2k0, k + or - 4k0,... in the matrix dispersion equation. In the diagonal approximation, investigations of detailed stability behavior range from the regime of strong instability (monoenergetic electrons) to weak resonant growth (sufficiently large energy spread). In the limit of ultrarelativistic electrons and very low beam density, the kinetic dispersion relation is compared with the dispersion relation obtained from a linear analysis of the conventional Compton-regime FEL equations. Finally, assuming ultrarelativistic electrons and a sufficiently broad spectrum of amplifying waves, the quasilinear kinetic equations appropriate to the planar wiggler configuration are presented. DOE

N86-16569# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
LINEAR ANALOG SIGNAL AMPLIFICATION BY BACKWARD RAMAN SCATTERING
C. H. Lin and M. A. Nelson 1985 6 p Presented at the 5th International Conference on Integrated Optics and Optical Fibre Communication and 11th European Conference on Optical Communications, Venice, Italy, 1 Oct. 1985
(Contract DE-AC08-83NV-10282)
(DE85-017164; EGG-10282-2072; CONF-8510144-1) Avail: NTIS HC A02/MF A01

A flashlamp-pumped dye laser has been employed to amplify an analog optical signal by backward Raman scattering in a multimode graded-index fiber. A gain of 28.5 dB and excellent time profile fidelity was achieved. DOE

N86-16570# Lawrence Livermore National Lab., Calif.
HIGH-BANDWIDTH FIBER-OPTIC SYSTEM USING LASER-DIODE TRANSMITTERS
B. L. Pruett, F. Roeske, R. A. Jones, and K. G. Hagans Jul. 1985 8 p Presented at the SPIE International Technical Symposium on Optical and Electro-optical Engineers, San Diego, Calif., 18 Aug. 1985 Prepared in cooperation with Edgerton, Germeshausen and Grier, Inc., Goleta, Calif. and Mitre Corp., Bedford, Mass.
(Contract W-7405-eng-48)
(DE85-017272; UCRL-92196; CONF-850887-26) Avail: NTIS HC A02/MF A01

A system has been developed to transmit analog signals through 1-km-long fiber-optic cables having bandwidths up to 1.5 GHz. Semiconductor injection laser-diode transmitters operating at a wavelength of about 815 nm are directly modulated by electrical signals from radiation detectors. Graded-index optical fibers transmit the optical signals to a remote facility, where they are recorded on a single streak camera. DOE

N86-16571# Rockwell International Corp., Golden, Colo.
FIBER OPTIC APPLICATIONS ON THE CENTURY-DETROIT LASER INTERFEROMETER GAGES
G. W. Dutton 19 Aug. 1985 16 p
(Contract DE-AC04-76DP-03533)
(DE85-017350; RFP-3778) Avail: NTIS HC A02/MF A01

The application of fiber optics on the Century-Detroit laser inspection gages is investigated. The effects of directing the laser beam into the gagehead interferometer by fiber optics, and using fiber optics to transmit the interference fringe signal from the interferometer to the photodetectors are examined. Both incoherent (nonimage-transmitting) and coherent (image-transmitting) optical bundles are tested. Results of these tests showed that neither the imaging nor the nonimaging fiber optic cables can be used to carry the laser beam into the gageheads. However, either type of cable can be used successfully to transmit the created fringe pattern to the photodetectors. DOE

N86-16572# Rochester Univ., N. Y. Lab. for Laser Energetics.
X-RAY DIAGNOSTIC METHODS FOR LASER IMPLODED TARGETS
B. Yaakobi 1985 42 p Presented at the Spring College on Radiation in Plasmas, Trieste, Italy, 1 Jun. 1985
(Contracts DE-AI08-81DP-40133; DE-AS08-81DP-40128; DE-AC08-80DP-40124)
(DE85-017583; DOE/DP-40124/73; CONF-8506189-2) Avail: NTIS HC A03/MF A01

Some recently developed X-ray diagnostic methods for laser irradiated targets are described. The first section deals with a method based on the observation of absorption X-ray lines formed when a continuum from a hot imploded core traverses a cooler surrounding tamper. The absorption lines, of atomic species in a thin layer embedded in the target tamper, can yield the tamper temperature and rho delta R. The second section describes a

variety of X-ray devices, currently under development, which should be useful in diagnosing high-density laser compression experiments. These include Von-Hamos focusing crystal spectrograph, Laue spectrograph, achromatic and polychromatic imaging with Laue crystals and X-ray interferometry. DOE

N86-16573# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
10 Dec. 1985 147 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-85-041) Avail: NTIS HC A07/MF A01

Current topics of interest in various scientific and technical fields are reported on from the People's Republic of China. Topics discussed include: (1) physical science; (2) applied sciences; (3) environmental quality; (4) chemistry; (5) compuer science; and (6) physics. For individual titles, see N86-16574 through N86-16583.

N86-16574# Joint Publications Research Service, Arlington, Va.
IMPROVED METHOD FOR TRANSONIC FLOW CALCULATION PROPOSED **c02**
Luo Shifeng *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 24-33 refs Transl. into ENGLISH from Shuzhi Jisuan yu Jisuanji Yingyong (Beijing, China), v. 6, no. 1, Mar. 1985 p 57-64 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

The steady-state transonic flow field consists of the subsonic and supersonic regions. In the subsonic region, AF1 scheme is used, and in the supersonic region, AF2 scheme is used. The parameter in AF1 scheme is linearly variant with period. A lot of cases were calculated. Results indicate that the convergence rate of the type-dependent splitting scheme is very fast. Author

N86-16575# Joint Publications Research Service, Arlington, Va.
GEOMETRIC DEFINITION OF UNIFORM B-SPLINE CURVES **c64**
Shi Fazhong *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 34-44 refs Transl. into ENGLISH from Shuzhi Jisuan yu Jisuanji Yingyong (Beijing, China), v. 6, no. 1, Mar. 1985 p 49-56 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

J. H. Clark defined uniform B-spline curves and the standard uniform B-splline. He has not however, established the general forms. Based on Clark's work, the general geometric definition of uniform B-spline curves are established, the general formulas of uniform B-spline basic functions are derived, and a series of properties and formulas calculating the uniform B-spline basic function and uniform B-spline curves is obtained. Author

N86-16576# Joint Publications Research Service, Arlington, Va.
PASSIVE MODE-LOCKING OF AN XeCl* EXCIMER LASER
Cheng Xusan, Lou Qihong, and Wang Runwen *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 45-50 refs Repr. from Guangxue Xuebao (Shanghai, China), v. 5, no. 7, Jul. 1985 p 643-647 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

Mode locking of an XeCl excimer laser was achieved with napthtnalene and PPT for the first time, using a simple, compact soft focus light path; a pulse width of 3 ns, over 90 percent modulation, a total output energy of 6.3 mJ, and a spatial divergence angle of 2mrad in a pulse train of 4 to 5 distinct 3-ns spikes was obtained. Author

N86-16577# Joint Publications Research Service, Arlington, Va.
A COUMARIN C102 DYE LASER PUMPED BY A 308-NM XeCl LASER
Shangguan Cheng, Lin Yingyi, Wang Yiman, and Dou Airong *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 51-54 refs Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 8, 20 Aug. 1985 p 476-477 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

An experimental study of a coumarin C102 tunable dye laser pumped by a 308-nm XeCl excimer laser is described. The tuning range is from 4605 to 5010 angstroms and the tuning linewidth is about 1 angstroms. Author

N86-16578# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF LARGE-COLUME X-RAY PREIONIZED XeCl EXCIMER LASER
Lou Qihong, Cheng Xusan, Ding Aizheng, Wei Yunrong, Ding Zean, and Zheng Chengen *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 55-59 refs Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 8, 20 Aug. 1985 p 468-470 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

The characteristics of a large-volume XeCl excimer laser, including improved uniformity of X-ray preionization and unstable cavity output, were studied experimentally. A maximum pulse energy of 1.6 J was obtained. Author

N86-16579# Joint Publications Research Service, Arlington, Va.
SINGLE-MODE Ne3+ GLASS LASER DESCRIBED
Zhang Guifen *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 60-65 refs Transl. into ENGLISH from Guangxue Xuebao (Shanghai, China), v. 7, no. 7, Jul. 1984 p 585-589 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

A high-power single-mode output has been obtained from an unstable ring laser made of neodymium glass, using an LiF:F2 saturable absorber crystal as a Q switch. A preliminary discussion of the experimental results is presented. Author

N86-16580# Joint Publications Research Service, Arlington, Va.
USE OF MICROPROCESSOR FOR IMAGE PROCESSING **c61**
Liu Weixian, Sun Xuemei, and Li Kaili *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 69-73 Transl. into ENGLISH from Weijisuanji Yingyong (Beijing, China), v. 6, no. 2, Mar. 1985 p 47-49 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

One of the striking characteristics of image signal processing is the immense amount of data involved. In the past it was customary to associate digital image processing with large- and medium-sized computers. In recent years microcomputer technology has developed rapidly, and the capabilities and capacities of such computers have expanded rapidly, while their price has fallen continuously. The use of microcomputers to create various types of image processing systems is receiving increasingly serious consideration. An image processing system which is based on a Z-80 single board computer is described. G.L.C.

N86-16581# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER FAST FOURIER TRANSFORM SYSTEM DESCRIBED **c61**
Jiang Yinlin *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 74-83 refs Transl. into ENGLISH from Weijisuanji Yingyong (Beijing, China), v. 6, no. 2, Mar. 1985 p 18-24 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

The DPS-85 data collection and analysis system includes a rather powerful FFT (fast Fourier transform) processing capability which is lacking in ordinary microcomputer systems. As a result, it can be used not only as an ordinary microcomputer, but also as a simple FFT signal analyzer which is extremely well adapted for low-frequency signal processing. G.L.C.

N86-16582# Joint Publications Research Service, Arlington, Va.
FIELD DISTRIBUTION IN A BENT SINGLE-MODE OPTICAL FIBER **c74**
Bao Zhenwu *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 84-91 refs Transl. into

ENGLISH from Tianjin Daxue Xuebao (Tianjin, China), no. 4, Dec. 1984 p 97-102 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

An approximate equation for the field distribution of a bent single-mode fiber is presented. Measurements of the field distribution using the near-field pattern (NFP) method gave results in agreement with theoretical predictions. Author

N86-16583# Joint Publications Research Service, Arlington, Va.
KrCl-XeCl DOUBLE LASER OSCILLATION REPORTED
Ma Shusen, Yao Yongbang, Shan Xinxin, Zhu Jikang, Qin Yuying, Wang Guangchang, and Cai Lianxin *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 92-96 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 9, 20 Sep. 1985 p 521-523 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

Double laser oscillation from KrCl and XeCl on the same discharge pulse was obtained in a Kr-Xe-HCl-He gas mixture. The KrCl emission was about 12 ns later than the XeCl emission. The xenon partial pressure is critical to double oscillation. Author

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-16584 Ohio State Univ., Columbus.
NUMERICAL SOLUTION OF ELASTIC CONTACT PROBLEMS INCLUDING FRICTION Ph.D. Thesis
Kisu Lee 1985 171 p
Avail: Univ. Microfilms Order No. DA8518977

Several numerical methods to solve frictional contact problems have been proposed in recent years. These techniques have different degrees of sophistication and generality in the formulation as well as in the employed solution algorithm. However, a concrete demonstration of convergence of solution method is not found in the open literature. A numerically convergent method of solution is proposed for a class of frictional contact problems involving two or more elastic bodies. Convergence of the proposed solution algorithm is shown theoretically as well as numerically. The classical friction law of Coulomb is applied in an incremental fashion to the discrete equations that can be obtained by employing the finite element method. Applications to study the effect of friction on an interior crack under a general loading, the interaction of a crack and material interfaces, and thermal expansion of two or more dissimilar elastic bodies are presented. Dissert. Abstr.

N86-16585 Department of the Army, Washington, D. C.
MICROWAVE DRYING OF AMMONIUM PERCHLORATE GRINDING SPHERES Patent
D. C. Sayles, inventor (to Army) Issued 30 Apr. 1985 4 p
(AD-D011900; US-Patent-4,513,513; US-Patent-Appl-SN-550435; US-Patent-Class-34-1) Avail: US Patent and Trademark Office CSCL 13/9

Disclosed is a method of microwave drying of ammonium perchlorate grinding spheres. A preferred embodiment of the method employs a tunnel oven in combination with a microwave generator having an appropriate power supply. The tunnel oven receives microwave energy through transmission ducts in communication with a channeling device to distribute microwave energy over the grinding spheres to be dried. A preheated air supply facilitates moisture removal from the tunnel oven after the moisture adhered or occluded to the grinding spheres' surfaces is evaporated from the grinding spheres as a result of molecular vibrations of the water molecules after they absorb the microwave energy. A predetermined microwave frequency range and a predetermined drying time are employed to more efficiently remove adhered or occluded moisture from carbide grinding spheres as compared to conventional convection drying. Author (GRA)

N86-16586*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
INVESTIGATION OF WELD JOINT DETECTION CAPABILITIES OF A COAXIAL WELD VISION SYSTEM
K. J. Gangl and J. L. Weeks Oct. 1985 22 p
(Contract NAS8-27980)
(NASA-CR-178537; NAS 1.26:178537) Avail: NTIS HC A02/MF A01 CSCL 13H

This report describes the second phase of a series of evaluations of a vision-based welding control sensor for the Space shuttle Main Engine Robotic Welding System. The robotic welding system is presently under development at the Marshall Space Flight Center. This evaluation determines the factors influencing the minimum joint gap required for consistent detection of the weld joint. Author

N86-16587*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
INFLUENCE OF CONTROL PARAMETERS ON THE JOINT TRACKING PERFORMANCE OF A COAXIAL WELD VISION SYSTEM
K. J. Gangl and J. L. Weeks Oct. 1985 27 p
(Contract NAS8-27980)
(NASA-CR-178538; NAS 1.26:178538) Avail: NTIS HC A03/MF A01 CSCL 13H

The first phase of a series of evaluations of a vision-based welding control sensor for the Space Shuttle Main Engine Robotic Welding System is described. The robotic welding system is presently under development at the Marshall Space Flight Center. This evaluation determines the standard control response parameters necessary for proper trajectory of the welding torch along the joint. Author

N86-16588# Department of Energy, Washington, D. C.
PROCESS FOR FORMING UNUSUALLY STRONG JOINTS BETWEEN METALS AND CERAMICS BY BRAZING AT TEMPERATURES THAT DO NOT EXCEED 750(0)C Patent Application
J. P. Hammond (Oak Ridge National Lab., Tenn.), S. A. David (Oak Ridge National Lab., Tenn.), and J. J. Woodhouse, inventors (to DOE) (Oak Ridge National Lab., Tenn.) Filed 4 Dec. 1984 19 p
(Contract DE-AC05-84OR-21400)
(DE85-017731; US-Patent-Appl-SN-677955) Avail: NTIS HC A02/MF A01

This investion is a process for joining metals to ceramics to form very strong bonds using low brazing temperature, i.e., less than 750 C, and particularly for joining nodular cast iron to partially stabilized zirconia. The process provides that the cermaic be coated with an active metal, such as titanium, that can form an intermetallic with a low melting point brazing alloy such as 60Ag-30Cu-10Sn. The nodular cast iron is coated with a noncarbon containing metal, such as copper, to prevent carbon in the nodular cast iron from dissolving in the brazing alloy. These coated surfaces can be brazed together with the brazing alloy between at less than 750(0) C to form a very strong joint. An even stronger bond can be formed if a transition piece is used between the metal and ceramic. It is preferred for the transition piece to have a coefficient of thermal expansion compatible with the coefficient of thermal expansion of the ceramic, such as titanium. DOE

N86-16589# Department of Energy, Washington, D. C.
ABRASIVE SLURRY COMPOSITION FOR MACHINING BORON CARBIDE Patent Application
E. L. Duran, inventor (to DOE) (Los Alamos National Lab., N. Mex.) Filed 29 Nov. 1984 7 p
(Contract W-7405-eng-36)
(DE85-017722; US-Patent-Appl-SN-676045) Avail: NTIS HC A02/MF A01

An abrasive slurry, particularly suited for use in drilling or machining boron carbide, consists essentially of a suspension of boron carbide and/or silicon carbide grit in a carrier solution consisting essentially of a dilute solution of alkylaryl polyether alcohol in octyl alcohol. The alkylaryl polyether alcohol functions

as a wetting agent which improves the capacity of the octyl alcohol for carrying the grit in suspension, yet without substantially increasing the viscosity of the carrier solution. DOE

N86-16590# Oak Ridge National Lab., Tenn.
END POINT POSITION CONTROL OF A SINGLE LINK, TWO-DEGREE-OF-FREEDOM MANIPULATOR WITH JOINT COMPLIANCE AND ACTUATOR DYNAMICS
M. G. Forrest-Barlach, S. M. Babcock, H. Singh, and M. J. Rabins 1985 10 p Presented at ASME International Computers in Engineering Conference and exhibition, Boston, Mass., 4 Aug. 1985 Prepared in cooperation with Wayne State Univ., Detroit, Mich.
(Contract DE-AC05-84OR-21400)
(DE85-016307; CONF-850862-4) Avail: NTIS HC A02/MF A01

One problem which limits the cycle time of typical industrial manipulators is the vibration which results if the modes of vibration of a manipulator with significant joint compliance are excited. In this paper the effects of joint compliance in a two-degree-of-freedom manipulator are modeled and a study of several possible controller structures is conducted for the problem of end point position control. Controller structures considered include independent joint control neglecting compliance and independent joint control including actuator dynamics and joint compliance. A nonlinear observer which reduces the number of state measurements required is developed. Simulation of various controllers is performed utilizing ACSL, Advanced Continuous Simulation Language. It is shown that the closed loop frequency response of the manipulator can be increased beyond the typical industrial limit of 50% of the manipulator's natural frequency while maintaining desirable response characteristics by considering the joint compliance in the design and providing suitable feedback measurements. Simulations suggest satisfactory performance can be obtained as high as the limit imposed by the manipulators unmodeled higher vibration modes. The effects of motor torque limiting are investigated via simulation. The results demonstrate that the advantage of including actuator dynamics and compliance in the design is maintained when practical torque limitations of the motors are considered. DOE

N86-16591# Lawrence Livermore National Lab., Calif.
INDENTATION OF A PLANE MEMBRANE WITH A RIGID PARABOLOID
W. W. Feng 7 Mar. 1985 9 p Presented at the International Conference on Non-Linear Mechanics, Shanghai, China, 28 Oct. 1985
(Contract W-7405-eng-48)
(DE85-012945; UCRL-92301; CONF-851096-1) Avail: NTIS HC A02/MF A01

The indentation of a rectangular nonlinear hyperelastic membrane by a rigid paraboloid is presented in this paper. The strain-energy-density function for the membrane is assumed to have the Mooney form. The total potential energy of the deformed membrane can be obtained by integration. Due to the presence of a rigid indentor, the total potential energy for a deformed membrane is subjected to an inequality constraint condition. A slack variable is introduced to convert the inequality constraint condition into an equality constraint condition. Furthermore, a substitutional method is used to eliminate one of the unknown variables. In order to solve for the remaining unknown variables, the Raleigh-Ritz method and the minimum potential energy principle are employed. The deformations of a square membrane under various degrees of indentation are presented. DOE

N86-16592# Tennessee Univ., Knoxville.
ROBOTIC DESIGN ANALYSIS BASED ON TELEOPERATED MANIPULATOR DATA COLLECTION
R. S. Stoughton and H. L. Martin 2 Jun. 1985 26 p Presented at the Robots 9 Conference, Detroit, Mich., 2 Jun. 1985 Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract DE-AC05-84OR-21400)
(DE85-016404; CONF-8506106-2) Avail: NTIS HC A03/MF A01

Extensive data collection was performed on a servomanipulator system (TeleOperator Systems SM-229) to determine the motion range and mechanical power usage of the manipulator under direct human control. More than 50 hours of various manipulation operations were performed while joint positions and motor currents were recorded. Reduction of these data yielded histograms of the manipulator usage patterns revealing areas where future manipulator motion ranges and drive systems could be optimized. This report develops a graphical representation of mechanical power usage that relates torque and velocity to the total usage time. Methods of interpreting this representation are discussed and generalized for use in analyzing robotic systems. The resulting technique will allow designers to reevaluate an operating system and determine how to improve that system's design. DOE

N86-16593# Oak Ridge National Lab., Tenn.
WELDING STUDIES OF NICKEL ALUMINIDE AND NICKEL-IRON ALUMINIDES
M. L. Santella, S. A. David, J. A. Horton, C. L. White, and C. T. Liu Aug. 1985 38 p refs
(Contract DE-AC05-84OR-21400)
(DE85-018168; ORNL-6194) Avail: NTIS HC A03/MF A01

Because welding is often used during the fabrication of structural components, one of the key issues in the development of nickel aluminides and nickel-iron aluminides for engineering applications is their weldability. The goals of this study were to characterize weldment microstructures and to identify some of the factors controlling weldability of ductile Ni3Al alloys. The alloys used in this initial study were Ni3Al containing 500 wppm boron and Ni3Al containing 10 at. % iron and either 500 wppm or 20 wppm boron. Full-penetration autogenous welds were made in sheet shock by the electron beam (EB) and gas tungsten arc (GTA) processes. The main process variables were travel speed and preheat. The as-welded coupons were examined visually and in detail by the usual optical and electron metallographic methods. Weldments of boron-doped Ni3Al were composed of nearly 100% ordered (GAMMA)' phase. Weldments of the nickel-iron aluminides were (GAMMA)' + (BETA)' phase mixtures, with martensitic (BETA)' distributed interdendritically in the fusion zone and decorating grain boundaries in the heat-affected zone. All welds made in this particular boron-doped Ni3Al alloy contained cracks. Weldability improved with the addition of iron, and defect-free welds were made in the nickel-iron aluminides by both EB and GTA welding. Nevertheless, the iron-containing alloys were susceptible to cracking, and their weldability was affected by boron concentration, welding speed, and (for GTA) gas shielding. Defect-free welds were found to have good tensile properties relative to those of the base metal. DOE

N86-16594# Department of Energy, Washington, D. C.
FLEXIBLE SWIVEL CONNECTION Patent Application
J. C. Hoh, inventor (to DOE) Filed 19 Feb. 1985 8 p
(Contract W-31-109-eng-38)
(DE85-017802; US-Patent-Appl-SN-702540) Avail: NTIS HC A02/MF A01

A flexible swivel boot connector for connecting a first boot shield section to a second boot shield section is described. This invention relates to connections between boot shields for remote manipulators. This invention provides a means for joining two boot shield sections which is not subject to failure due to the stresses of operation. DOE

N86-16595# Rolls-Royce Ltd., Derby (England).
THE TECHNICAL DEVELOPMENT OF COOLED GAS TURBINE BLADES
Sh. Robbins and H. Tubbs 23 Jul. 1985 85 p refs
(PNR-90292) Avail: NTIS HC A05/MF A01

The history of cooling technology development within Rolls Royce is presented. A list of patents is given. The described systems include those of Conway, Dart, Tyne, Spey and Avon engines. The technical problems related to cost, weight, stress, vibration and performance are discussed. Author (ESA)

N86-16596# Transportation Systems Center, Cambridge, Mass.
PROCEEDINGS: DIRECT FIXATION FASTENER WORKSHOP

Final Report
Jun. 1985 263 p refs Proc. held in Atlanta, Georgia, 8-9 Feb. 1985
(Grant DOT-UMTA-MA-06-0153)
(PB85-247625; DOT/TSC-UMTA-85-10; UMTA-MA-06-0153-85-3) Avail: NTIS HC A12/MF A01 CSCL 13E

The report is a collection of papers and discussion transcripts from a workshop on direct fixation fastener systems (DFFSs), which are increasingly being used in the construction of modern rail systems and system extensions. A DFF is defined herein as a device anchored to a concrete slab in tunnels, aerial structures, and atgrade with a thick pad of elastomeric material bonded to a top (and sometimes bottom) metallic plate to which the rail is affixed by means of either bolts or resilient slips. Author (GRA)

N86-16597# Colorado State Univ., Fort Collins. Natural Resources Ecology Lab.
EFFECTS OF ACIDIC PRECIPATION ON THE NORTH AMERICAN CONTINENT
J. H. Gibson and R. A. Linthurst Aug. 1985 22 p refs
(PB85-239382; EPA-600/D-85-179) Avail: NTIS HC A02/MF A01 CSCL 06F

Since the mid 70's there has been a growing concern in the U.S. and Canada about the widespread deposition of acidic materials from the atmosphere. A major response in both Canada and the U.S. has been the organization of nationwide monitoring programs to assess the geographic and temporal trends in chemical deposition and the initiation of surveys and research efforts to determine current and future impacts on aquatic and terrestrial systems. Surveys based on geological materials and soil types indicate sensitive areas in both countries. Gradual acidification of lakes and streams has seriously affected fish populations in some areas. Leaching of aluminum, heavy metals and plant nutrients from soils affect water quality and may have implications with respect to reduced forest productivity. Extensive programs are underway to determine the extent of potential damage to crops and economic losses. Author (GRA)

N86-16433# Joint Publications Research Service, Arlington, Va.
PROSPECTS OF MAKING, BUYING, USING ROBOTS VIEWED
Gitta Takacs *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 23-27 Transl. into ENGLISH from Figyelo (Budapest, Hungary), no. 39, 27 Sep. 1985 p 6 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

N86-16434# Joint Publications Research Service, Arlington, Va.
VAMOS VIEWS NEEDS FOR ROBOT PRODUCTION
G. T. *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 30-34 Transl. into ENGLISH from Figyelo (Budapest, Hungary), no. 39, 27 Sep. 1985 p 7 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-16598*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NDE OF STRUCTURAL CERAMICS
Stanley J. Klima and Alex Vary 1986 14 p refs Proposed for presentation at the 31st International Gas Turbine Conference, Dusseldorf, West Germany, 8-12 Jun. 1986; sponsred by ASME
(NASA-TM-87186; E-2840; NAS 1.15:87186) Avail: NTIS HC A02/MF A01 CSCL 14D

Radiographic, ultrasonic, scanning laser acoustic microscopy (SLAM), and thermo-acoustic microscopy techniques were used to characterize silicon nitride and silicon carbide modulus-of-rupture test specimens in various stages of fabrication. Conventional and microfocus X-ray techniques were found capable of detecting minute high density inclusions in as-received powders, green compacts, and fully densified specimens. Significant density gradients in sintered bars were observed by radiography, ultrasonic velocity, and SLAM. Ultrasonic attenuation was found sensitive to microstructural variations due to grain and void morphology and distribution. SLAM was also capable of detecting voids, inclusions and cracks in finished test bars. Consideration is given to the potential for applying thermo-acoustic microscopy techniques to green and densified ceramics. The detection probability statistics and some limitations of radiography and SLAM also are discussed. Author

N86-16599*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RELIABILITY OF SCANNING LASER ACOUSTIC MICROSCOPY FOR DETECTING INTERNAL VOIDS IN STRUCTURAL CERAMICS
Don J. Roth and George Y. Baaklini 1986 36 p refs Presented at the 10th Annual Conference on Composites and Advanced Ceramic Materials, Cocoa Beach, Fla., 19-22 Jan. 1986; sponsored by the American Ceramic Society
(NASA-TM-87222; E-2864; NAS 1.15:87222) Avail: NTIS HC A03/MF A01 CSCL 14D

The reliability of 100 MHz scanning laser acoustic microscopy (SLAM) for detecting internal voids in sintered specimens of silicon nitride and silicon carbide was evaluated. The specimens contained artificially implanted voids and were positioned at depths ranging up to 2 mm below the specimen surface. Detection probability of 0.90 at a 0.95 confidence level was determined as a function of material, void diameter, and void depth. The statistical results presented for void detectability indicate some of the strengths and limitations of SLAM as a nondestructive evaluation technique for structural ceramics. Author

N86-16600# Purdue Univ., West Lafayette, Ind. Dept. of Statistics.
SELECTION AND RANKING PROCEDURES IN RELIABILITY MODELS
S. S. Gupta and S. Panchapakesan Jul. 1985 49 p
(Contract N00014-84-C-0167)
(AD-A157864; AD-E440288; TR-85-16) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several procedures appropriate for selecting the best from K $<$ or $=$ 2) life length distributions are discussed. The selection problem is considered under the classical formulation using both the indifference zone and subset selection approaches, but mostly the latter. Under parametric models, procedures are described for selection from gamma, Weibull, and exponential (one-and two-parameter) distributions. Nonparametric procedures and distribution-free procedures are discussed for selection in terms of a specified quantile and reliability at an arbitrarily chosen point in time, respectively. Procedures for selection from restricted families are discussed with special reference to IFR and IFRA families. The procedures described in various cases mentioned above illustrate several modifications and generalizations of the basic goal. Author (GRA)

N86-16601# Rockwell International Corp., Golden, Colo.
FINITE ELEMENT MODELING OF PULSED EDDY CURRENT NDT PHENOMENA
B. Allen, N. Ida, and W. Lord 15 May 1985 5 p refs Presented at the 5th Conference on the Computation of Electromagnetic Fields, Ft. Collins, Colo., 3 Jun. 1985 Prepared in cooperation with Colorado State Univ., Fort Collins and Akron Univ. Ohio
(Contract DE-AC04-76DP-03533)
(DE85-013221; RFP-3835; CONF-850641-5) Avail: NTIS HC A02/MF A01

Transient fields for nondestructive testing (pulsed eddy current methods) have been used experimentally for such applications as coating thickness measurements and the inspection of reactor fuel tubing. The lack of suitable models to facilitate understanding

of the interaction of the pulsed field with the test specimen has hindered a wider acceptance of the method as a tool in NDT. Two models, based on the finite element technique are described. The first model, used for repetitive pulse train sources makes use of the Fourier series of the source current to solve a steady state problem for each significant harmonic. The harmonic solutions are then summed to produce the total EMF in the pickup coil. The second model is used for single pulse application. The response is calculated using an iterative time stepping solution. In both cases axisymmetric geometries are studied using a magnetic vector potential formulation. Solutions are compared with experimental results. DOE

N86-16602# Lawrence Livermore National Lab., Calif.
RADIATION INTERACTIONS FOR TOMOGRAPHY, REVISION 1
A. S. Zoinay 20 May 1985 13 p Presented at the American Society of Nondestructive Testing Spring Conference, Washington, D.C., 11 Mar. 1985 Previously announced as N85-30799
(DE85-013792; UCRL-92271-Rev-1; CONF-8503121-1-Rev-1)
Avail: NTIS HC A02/MF A01

There are new requirements emerging in the field of tomography: the need for spatial resolution in the micrometer range, atomic species specificity, and quantitative density discrimination. DOE

N86-16603# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
SYSTEMS SAFETY, AN EXAMPLE OF APPLICATION [LA SECURITE DES SYSTEMES, UN EXEMPLE D'APPLICATION]
Michel Louet and Pierre Barrault (CR2A, Nanterre, France) 1985 22 p In FRENCH Presented at 3rd Seminaire Europeen sur la Securite des Systemes, Cannes, France, 19-21 Sep. 1984
(SNIAS-852-422-107) Avail: NTIS HC A02/MF A01

The experience gained in the safety analysis of missiles onboard submarines is demonstrated for the case where a second stage falls during assembly. A probability analysis of all possible causes is given. It is concluded that the reliability of a system must be studied following the outlined method. Author (ESA)

N86-16604# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
PARAMETERS TO BE CONTROLLED FOR AEROSPACE ADHESIVE BONDED STRUCTURES [PARAMETRES A MAITRISER EN VUE D'UN COLLAGE STRUCTURAL AEROSPATIALE]
G. Hilaire and J. N. Dewas 21 Jun. 1985 20 p In FRENCH Presented at Journees SFM/AAAF sur les Problemes Mecaniques et Thermiques des Satellites Conference, Suresnes, France
(SINIAS-852-551-102; C-47-401) Avail: NTIS HC A02/MF A01

The quality control of adhesive bonded joints is discussed. The analysis includes the characterization of the materials to be bonded, the adhesive system parameters, the quality control of the surfaces to be bonded, the process control of manufacturing and polymerization, the final inspection, and space applications. Examples of adhesive uses in satellite structures are given. Author (ESA)

N86-16465# Selenia S.p.A., Rome (Italy).
THE COMBINED EFFECT OF INFANT MORTALITY AND INSTALLATION PLAN ON MEAN TIME BETWEEN FAILURE
Giuseppe Rosato and Lamberto Pescatori *In its* Rivista Tecnica Selenia, Vol. 9, No. 2, 1985 1985 p 25-33 (For primary document see N86-16462 07-32)
Avail: NTIS HC A03/MF A01

N86-16617# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AVIP AIR FORCE THRUST FOR RELIABILITY
John C. Halpin *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 5-19 (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/4

N86-16619# LTV Aerospace and Defense Co., Dallas, Tex. Missiles and Advanced Programs Div.
A DECADE OF RELIABILITY TESTING PROGRESS
Robert N. Hancock *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 29-41 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/4

N86-16620# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
CERT: WHERE WE HAVE BEEN, WHERE WE ARE GOING
Alan Burkhard *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 43-49 (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/4

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-16605 Iowa Univ., Iowa City.
CORRELATION BETWEEN SHORT AND LONG FATIGUE CRACK GROWTH BEHAVIOR IN SAE 0030 CAST STEEL AND AISI 1020 HOT-ROLLED STEEL Ph.D. Thesis
Hyun Woo Lee 1985 171 p
Avail: Univ. Microfilms Order No. DA8518852

Constant amplitude fatigue crack growth behavior was investigated for physically short cracks ($0.3 < \text{or} = a < 1$ mm) and for long cracks ($a > \text{or} = 2$ mm) using SEN type specimens in SAE 0030 cast steel and AISI 1020 wrought steel with load ratios of $R = 0.05$, 1/2, and -1 at room temperature. A crack closure model which considered the residual plastic zone, fracture surface roughness and environmental effects was developed to correlate these two crack length ranges by introducing a transient crack length. It was found that the short cracks grew faster than long cracks based upon applied delta K with $da/DN < \text{or} = 4 \times 10$ to the minus 8 power m/ cycle and the difference in growth rates between these two crack length ranges became greater with decreasing applied stress intensity factor range. The transient crack lengths where similitude with applied delta K existed were between 1 and 2 mm for all three load ratios and two steels. Applied threshold stress intensity factor ranges for short cracks were found to be about 40 to 55 percent smaller than the corresponding threshold stress intensity factor ranges for long cracks in both steels. Dissert. Abstr.

N86-16606 Rice Univ., Houston, Tex.
FINITE ELEMENT METHODS FOR PLATE BENDING Ph.D. Thesis
Young Wuk Kwon 1985 119 p
Avail: Univ. Microfilms Order No. DA8517219

The plate bending problem is one of the most fundamental problems in structural analysis. Numerical methods have been applied to this problem. Among those methods the finite element method has attracted much attention because of its general application to complex problems. However, the difficulty in satisfying the slope compatibility condition in a usual displacement-based finite element method has been a barrier to a plate bending problem. In this research the new mixed finite element equation is formulated using the Galerkin method to overcome the difficulty mentioned above. Unknowns are moments and a lateral displacement. This eliminates the difficulty of slope compatibility. Moments are obtained accurately at nodal points. This formulation includes shear deformations for thick plate problems and is extended for anisotropic and layered composite materials. In

addition, this study includes an elasto-plastic analysis of plate bending problems. Dissert. Abstr.

N86-16607 Connecticut Univ., Storrs.
THREE DIMENSIONAL CRACK ANALYSIS BY FINITE ELEMENT METHOD WITH BOUNDARY INTEGRAL METHOD AT CRACK TIP Ph.D. Thesis
Tae Moon Kim 1985 176 p
Avail: Univ. Microfilms Order No. DA8516198

Three dimensional crack analysis by the conventional finite element method requires very small elements concentrated at the crack tip region to account for singular behavior. In this approach the number of equations to be solved increases drastically as improvement in accuracy is desired. In the new approach developed in this dissertation, a large element is used at the crack tip by employing the boundary integral equation method to account for the singular behavior of the stress components. This results in a much smaller number of equations to be solved. The numerical results by the new approach are very accurate even though few elements are used along the crack front. Furthermore, this new approach can deal with three dimensional crack problems under different types of loading and different crack locations without any difficulty or additional modification. Dissert. Abstr.

N86-16608*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A REFINED SHEAR DEFORMATION THEORY FOR THE ANALYSIS OF LAMINATED PLATES Annual Report, Mar. 1984 - Mar. 1985
J. N. Reddy Jan. 1986 37 p refs
(Grant NAG1-459)
(NASA-CR-3955; NAS 1.26:3955; VPI-E-85.26; AR-1) Avail: NTIS HC A03/MF A01 CSCL 20K

A refined, third-order plate theory that accounts for the transverse shear strains is presented, the Navier solutions are derived for certain simply supported cross-ply and antisymmetric angle-ply laminates, and finite-element models are developed for general laminates. The new theory does not require the shear correction factors of the first-order theory (i.e., the Reissner-Mindlin plate theory) because the transverse shear stresses are represented parabolically in the present theory. A mixed finite-element model that uses independent approximations of the generalized displacements and generalized moments, and a displacement model that uses only the generalized displacements as degrees of freedom are developed. The displacement model requires C sup 1-continuity of the transverse deflection across the inter-element boundaries, whereas the mixed model requires a C sup 0-element. Also, the mixed model does not require continuous approximations (between elements) of the bending moments. Numerical results are presented to show the accuracy of the present theory in predicting the transverse stresses. Numerical results are also presented for the nonlinear bending of plates, and the results compare well with the experimental results available in the literature. Author

N86-16609# Delaware Univ., Newark.
SHORT-WAVELENGTH BUCKLING AND SHEAR FAILURES FOR COMPRESSION-LOADED COMPOSITE LAMINATES Ph.D. Thesis
Mark J. Shuart Dec. 1985 228 p refs
Avail: NTIS HC A11/MF A01

The short wavelength buckling of multi-directional composite laminates loaded in compression is studied. Also investigated are the interlaminar shear failures due to short-wavelength imperfections and the inplane shear failures in these laminates. Author

N86-16610*# Akron Univ., Ohio. Dept. of Civil Engineering.
THERMOMECHANICAL CYCLIC HARDENING BEHAVIOR OF HASTELLOY-X M.S. Thesis
Paul A. Bartolotta Nov. 1985 54 p refs
(Grant NAG3-379)
(NASA-CR-174999; NAS 1.26:174999) Avail: NTIS HC A04/MF A01 CSCL 20K

Experimental evidence of thermomechanical history dependence on the cyclic hardening behavior of a representative combustor liner material Hastelloy-X is presented, along with a discussion about the relevant concept of thermomechanical path dependence. Based on the experimental results, a discussion is given on the inadequacy of formulating nonisothermal constitutive equations solely on the basis of isothermal testing. Finally, the essence of a mathematical representation of thermoviscoplasticity is presented that qualitatively accounts for the observed hereditary behavior. This is achieved by formulating the scaler evolutionary equation in an established viscoplastic theory to reflect thermomechanical path dependence. Although the necessary nonisothermal tests for further quantifying the thermoviscoplastic model have been identified, such data are not yet available. Author

N86-16611*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MASS BALANCING OF HOLLOW FAN BLADES
Robert E. Kielb 1986 15 p refs Proposed for presentation at the 31st International Gas Turbine Conference, Dusseldorf, West Germany, 8-12 Jun. 1985; sponsored by ASME
(NASA-TM-87197; E-2851; NAS 1.15:87197) Avail: NTIS HC A02/MF A01 CSCL 20K

A typical section model is used to analytically investigate the effect of mass balancing as applied to hollow, supersonic fan blades. A procedure to determine the best configuration of an internal balancing mass to provide flutter alleviation is developed. This procedure is applied to a typical supersonic shroudless fan blade which is unstable in both the solid configuration and when it is hollow with no balancing mass. The addition of an optimized balancing mass is shown to stabilize the blade at the design condition. Author

N86-16612*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIENCES WITH A PRELIMINARY NICE/SPAR STRUCTURAL ANALYSIS SYSTEM
Christine G. Lotts and William H. Greene Oct. 1985 39 p refs
(NASA-TM-87586; NAS 1.15:87586) Avail: NTIS HC A03/MF A01 CSCL 20K

Development of a new structural analysis system based on the original SPAR finite element code and the NICE system is described. The system is denoted NICE/SPAR. NICE was designed at Lockheed Palo Alto Research Laboratory and contains data management utilities, a command language interpreter, and a command language definition for integrating engineering computational modules. SPAR is a system of programs used for finite element structural analysis developed for NASA by Engineering Information Systems, Inc. It includes many complementary structural analysis and utility functions which communicate through a common database. The work on NICE/SPAR was motivated by requirements for a highly modular and flexible structural analysis system to use as a tool in carrying out research in computational methods and exploring new computer hardware. Analysis examples are presented which demonstrate the benefits gained from a combination of the NICE command language with the SPAR computational modules. Author

N86-16613*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRESS ANALYSIS OF 27% SCALE MODEL OF AH-64 MAIN ROTOR HUB
Robert V. Hodges Oct. 1985 49 p refs
(NASA-TM-87625; NAS 1.15:87625; AVSCOM-TR-85-B-8) Avail: NTIS HC A03/MF A01 CSCL 01C

Stress analysis of an AH-64 27% scale model rotor hub was performed. Component loads and stresses were calculated based upon blade root loads and motions. The static and fatigue analysis indicates positive margins of safety in all components checked. Using the format developed here, the hub can be stress checked for future application. Author

N86-16614*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECT OF DEBOND GROWTH ON STRESS-INTENSITY FACTORS IN A CRACKED ORTHOTROPIC SHEET STIFFENED BY A SEMI-INFINITE ORTHOTROPIC SHEET

C. A. Bigelow Jan. 1986 26 p refs

(NASA-TM-87598; L-16027; NAS 1.15:87598) Avail: NTIS HC A03/MF A01 CSCL 20K

Stress-intensity factors are determined for a cracked infinite sheet adhesively bonded to a stringer, and debonding of the adhesive layer is predicted. The stringer is modeled as a semi-infinite sheet. Adhesive nonlinearity is also included. Both the sheet and stringer are treated as homogeneous, orthotropic materials. A set of integral equations is formulated and solved to obtain the adhesive shear stresses and crack-tip stress-intensity factors. Adhesive debonding is predicted using a rupture criterion based on the combined adhesive stresses. When the crack is not under the stringer, the debond extends along the edge of the stringer. When the crack tip is beneath the stringer, the debond grows to the end of the crack, then along the edge of the stringer. Stress levels required for debond initiation decrease as the crack tip is moved beneath the stringer. With a nonlinear adhesive, the debond initiates at higher applied stress levels than in linear adhesive cases. Compared with the linear adhesive solution, modeling a nonlinear adhesive causes the stress-intensity factor to increase when the bond is assumed to remain intact but causes the stress-intensity factor to decrease when debonding is included. Author

N86-16615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SIMPLIFIED CYCLIC STRUCTURAL ANALYSES OF SSME TURBINE BLADES

A. Kaufman and J. M. Manderscheid 1986 17 p refs Proposed for presentation at the Conference on Advanced High Pressure Oxygen/Hydrogen Propulsion Technology, Huntsville, Ala., 14-16 May 1986; sponsored by NASA Marshall Space Flight Center (NASA-TM-87214; E-2873; NAS 1.15:87214) Avail: NTIS HC A02/MF A01 CSCL 20K

Anisotropic high-temperature alloys are used to meet the safety and durability requirements of turbine blades for high-pressure turbopumps in reusable space propulsion systems. The applicability to anisotropic components of a simplified inelastic structural analysis procedure developed at the NASA Lewis Research Center is assessed. The procedure uses as input the history of the total strain at the critical crack initiation location computed from elastic finite-element analyses. Cyclic heat transfer and structural analyses are performed for the first stage high-pressure fuel turbopump blade of the space shuttle main engine. The blade alloy is directionally solidified MAR-M 246 (nickel base). The analyses are based on a typical test stand engine cycle. Stress-strain histories for the airfoil critical location are computed using both the MARC nonlinear finite-element computer code and the simplified procedure. Additional cases are analyzed in which the material yield strength is arbitrarily reduced to increase the plastic strains and, therefore, the severity of the problem. Good agreement is shown between the predicted stress-strain solutions from the two methods. The simplified analysis uses about 0.02 percent (5 percent with the required elastic finite-element analyses) of the CPU time used by the nonlinear finite element analysis. Author

N86-16616# Shock and Vibration Information Center (Defense), Washington, D. C.

THE SHOCK AND VIBRATION BULLETIN 55. PART 1: WELCOME, KEYNOTE ADDRESS, INVITED PAPERS, ISOLATION AND DAMPING AND DAMPING PRACTICES Monthly Report

Jun. 1985 169 p refs Proceedings of the 55th Symposium on Shock and Vibration, Dayton, Ohio, 22-24 Oct. 1984; sponsored by ASD 3 Vol.

(AD-A160263; SVIC-Bull-55-Pt-1) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Presented are the welcome address and the keynote address for the 55th symposium on shock and vibration. Also in this section appears invited papers on reliability, damping practics, and damping and isolation. Some article topics include: (1) Avionics Integrity Program (AVIP) air force thrust for reliability; (2) a decade of reliability testing; (3) a different view of viscous damping; (4) passive damping, sonic fatigue and the KC-135; (5) passive load control dampers; and (6) vibration and damping analysis of curved sandwich panels. For individual titles, see N86-16617 through N86-16631.

N86-16617# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

AVIP AIR FORCE THRUST FOR RELIABILITY **c38**

John C. Halpin *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 5-19 (For primary document see N86-16616 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/4

An overview is given of the avionics integrity program. Some history is given as to how and why the program developed. The program concerns itself with the quality assurance and reliability of aircraft electronics. It is believed that the safety of avionics can be controlled by controlling the flaw size distribution and stress levels. Also preventive maintenance is briefly discussed. E.R.

N86-16618# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

DYNAMICS R AND D IN THE AFWAL STRUCTURES AND DYNAMICS DIVISION

James J. Olsen *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 21-27 (For primary document see N86-16616 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A brief overview of the recent accomplishments, current activities and plans for in-house R&D, contractual R&D and systems support in structural dynamics by the Air Force Wright Aeronautical Laboratories are given. Areas of specific concern are survivable structure, advanced aeronautical structural concepts, aircraft structural integrity, spacecraft structures, and structures and dynamics technology base. Several facilities for research and development in structural dynamics are briefly described. Author

N86-16619# LTV Aerospace and Defense Co., Dallas, Tex. Missiles and Advanced Programs Div.

A DECADE OF RELIABILITY TESTING PROGRESS **c38**

Robert N. Hancock *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 29-41 refs (For primary document see N86-16616 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/4

At the 45th shock and vibration symposium, which was held at the Dayton Convention Center in 1974, the S&V community was alerted to problems that existed in avionics reliability. A two year study described problems and some proposed fixes. The Air Force programs investigated many actions which are still in progress. The progress that has been made toward the solutions that were proffered at the 1974 meeting are reviewed and some of the tasks that still need development are listed. The problems that were disclosed in 1974 fell into both the technical and the administrative arenas. The latter will be mentioned where lack of action interferes with technical progress, the primary topic. Author

N86-16620# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

CERT: WHERE WE HAVE BEEN, WHERE WE ARE GOING **c38**

Alan Burkhard *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 43-49 (For primary document see N86-16616 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/4

Combined Environment Reliability Test (CERT) is discussed

where it has been and where the technology is going. What led to the development of this technology is discussed, what has been accomplished, and then what kind of activities and ideas are underway to move beyond CERT. Why was it necessary to develop the concept now called CERT? What is CERT? A thumbnail tutorial on the development of CERT is given, the engineering process one goes through to develop a CERT profile and finally how one might go about applying CERT in a contractual situation. The technology perception challenges that the development and validation of CERT uncovered is described. These are the areas that future development and focus of development efforts need to be undertaken. Author

N86-16621# Stress Technology, Inc., Rochester, N.Y.
FACTORS AFFECTING THE FATIGUE LIFE OF TURBINE BLADES AND AN ASSESSMENT OF THEIR ACCURACY
Neville P. Rieger *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 51-69 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Estimation of blade fatigue life is an important aspect of turbomachinery design because blade life often determines the operational survivability of an engine. During design, blade life estimates provide a quantitative criterion against which the influence of different design features can be compared. Blade life estimation involves the synthesis of several existing technologies, and life estimates are influenced by the state of knowledge in each contributing technology area. Certain technologies such as blade finite element modeling are now highly developed. Modern blade models have been shown to provide very accurate results for steady stresses and natural frequencies. Other areas such as blade excitation, damping, and certain aspects of materials properties are presently in a more formative stage, though these techniques also have experienced promising developments in recent years. These developments are discussed in detail. Author

N86-16622# Dayton Univ., Ohio. Research Inst.
SPIN PIT TEST OF BLADED DISK WITH BLADE PLATFORM FRICTION DAMPERS
R. J. Dominio *In* Shock and Vibration Information Center The Shock and Information Bulletin 55, Part 1 Jun. 1985 p 71-79 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A turbine blade friction damping study, involving both analytical and experimental evaluations, was performed for a high speed bladed disk of the high pressure fuel turbopump of the space shuttle main engine. The recently completed experimental study involved spin pit testing of an instrumented bladed disk assembly. The study was performed to evaluate the effectiveness and operational characteristics of blade platform friction dampers designed to limit damaging resonance vibrations of the turbine blades in their lower order flexural vibration modes. The test program is described and the test results are presented. A brief comparison is made between the results of the analytical and experimental studies. Author

N86-16623# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Aeronautics and Astronautics.
A DIFFERENNT VIEW OF VISCOUS DAMPING
P. J. Torvik and R. L. Bagley *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 81-83 (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The linear viscous damper has proven to be an extremely useful concept in the modeling of vibration systems. One usually justifies the inclusion of such elements in models of mechanical systems through the following argument: Consider two flat plates (or cylinders), parallel, infinite in extent, and separated by a distance h. Assume that the region between the two plates (or cylinders) is filled with a Newtonian fluid of viscosity mu. Assume that one plate (cylinder) is displaced parallel to the other at a speed V, or, in terms of a displacement coordinate, x. Assume further that the resulting velocity distribution between the two plates (cylinders) is linear. Then, the average shear stress in the fluid is proportional to the average velocity gradients, or: sigma = mu v/h. If A represents the wetted area of the moving plate (cylinder), hen the resisting force on that surface is F = A sigma = A mu v/h. From this it is deduced that the value of a dashpot constant to be C = A mu/n. Author

N86-16624# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
TEMPERATURE SHIFT EFFECTS ON COMPLEX MODULUS
James A. Eichenlaub and Lynn C. Rogers *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 85-87 (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The first step in using viscoelastic materials to control vibration is the accurate determination of the material. Since polymer properties exhibit a strong dependence on frequency and temperature, it is necessary to characterize samples over a wide range of temperatures and frequencies. It is impractical to measure all points of interest in the temperature and frequency ranges, therefore, some type of curve fitting is required to allow extrapolation of data at other temperatures and frequencies. To plot the modulus and loss factor in two dimensions, these properties must be functions of one variable which contains the two independent variables mentioned. The two independent variables may be combined using a temperature shift parameter to give a reduced frequency. In most material tests, experimental data cannot be collected over a sufficiently wide frequency range to define the temperature shift parameter equation. Therefore, an alternate method of defining the shift parameter is required. A method of defining the temperature shift parameter equation when the frequency range is inadequate to find it by inspection of the experimental data is presented. Author

N86-16625# Dayton Univ., Ohio. Research Inst.
PASSIVE DAMPING, SONIC FATIGUE AND THE KC-135A
P. A. Graf, M. L. Drake, M. P. Bouchard, and R. J. Dominic *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 89-101 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

High noise levels occurring during maximum thrust takeoff have caused sonic fatigue cracking of the aft fuselage skin and stringers of the KC-135A aircraft. A program was conducted to solve this problem through the design and evaluation of a passive damping system for the aft fuselage of the KC-135A. A detailed description of the program results is presented. Author

N86-16626# General Electric Co., Philadelphia, Pa. Space Systems Div.
DESIGN OF INTEGRALLY DAMPED SPACECRAFT PANELS
C. V. Stahle and J. A. Staley *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 103-107 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The results of preliminary design and analysis studies of damped spacecraft equipment mounting panels is presented. Increased vibroacoustic reliability and reduced program development costs can be achieved by controlling spacecraft equipment vibration during launch. To reduce the significant number of anomalies which occur shortly after launch, component vibration requirements have been increased to provide larger margins. This has resulted in a large number of vibroacoustic test failures during qualification and acceptance tests. A $40 million cost saving is estimated using the OCTAVE code if the equipment vibration environment is reduced 50 percent for an operational satellite system using a NIL-STD-1540 test program. To realize this high

payoff, the RELSAT project was initiated to develop and demonstrate damping control of satellite launch vibration. A typical satellite equipment panel was selected and analyzed. Author

N86-16627# Dayton Univ., Ohio. Rsearch Inst.
A DIFFERENT APPROACH TO DESIGNED IN PASSIVE DAMPING
M. L. Drake *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 109-117 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

In the past, most damping applications were additive designs used to solve field problems. Today, designers are beginning to consider integral (designed in) damping systems. This change in emphasis in damping design will change the market in damping materials. Soon the damping material vendor will be supplying damping materials in bulk form (sheets, rolls, uncured gum) to the structural system manufacturers. Since the damping materials will be required in bulk form, the possibility of ordering a custom formulated material exists. A method is demonstrated which develops the required damping material properties, discuss formulation changes usable to adjust the damping material properties, and discuss the benefits of such design procedures. Author

N86-16628# Martin Marietta Aerospace, Denver, Colo.
ANALYSIS OF DAMPED TWIN TOWERS
C. W. White *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 119-129 refs (For primary document see N86-16616 07-39)
(Contract F33615-83-C-3222)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The procedure used to design two viscoelastically damped 60-ft tall generic test towers is presented. How the Modal Strain Energy (MSE) approach was used to identify favorable locations in these towers for viscoelastic structural members and for discrete viscoelastic damper mechanisms is described. The use of standard viscoelastic material (VEM) property data to design the discrete dampers is illustrated. Testing procedures and data reduction required for theoretical experimental correlation are described at both the VEM element and truss system levels. Author

N86-16629# Boeing Aerospace Co., Seattle, Wash.
PASSIVE LOAD CONTROL DAMPERS
David M. Eckblad and Patrick James Schirmer *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 131-138 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The need to accommodate greater nuclear groundshock threats for a larger and heavier missile/canister within an existing underground site has led to a unique damper requirement which is satisfied using the passive load control damper. The design approach to develop this passive load control damper is described. Details in modeling the passive load control damper value dynamics are given. Dynamic analysis is compared with various levels of tests, showing good correlation. Author

N86-16630# Vermont Univ., Burlington. Dept. of Mechanical Engineering.
RESPONSE OF A SYMMETRIC SELF-DAMPED PNEUMATIC SHOCK ISOLATOR TO AN ACCELERATION PULSE
M. S. Hundal and D. J. Fitzmorris *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 139-153 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Pneumatic damping offers several advantages in shock and vibration applications including cleanliness, light weight and few moving parts. Large deflections of pneumatic shock absorbers make their behavior nonlinear and thus difficult to analyze. The analysis and response of a symmetric pneumatic absorber with orifice damping is detailed. With proper design such an absorber can provide a response to a shock pulse similar to that of a linear absorber. The response to a rectangular acceleration pulse is determined, which is the most severe pulse shape for a given duration. Results are given in the form of graphs and empirical formulas which can be used for design. An important conclusion reached is that there is a tradeoff between optimum shock isolation and optimum damped response. Author

N86-16631# Indian Inst. of Tech., New Delhi. Dept. of Mechanical Engineering.
VIBRATION AND DAMPING ANALYSIS OF CURVED SANDWICH PANEL WITH VISCOELASTIC CORE
J. Vaswani, N. T. Asnani, and B. C. Nakra *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 1 Jun. 1985 p 155-166 refs (For primary document see N86-16616 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Equations of motion for flexural vibrations of curved sandwich panel, consisting of elastic face layers sandwiching a viscoelastic core were derived considering extension and bending deformations in the face layers and shear deformation in the core layer, using variational principles. A solution for panel with simply supported edges is taken in series summation form and the correspondence principle of linear viscoelasticity is applied for evaluating the resonant frequencies and associated system loss factors. Effects of the variations of the geometric and the material parameters on the resonant frequencies and the system loss factors are reported. Author

N86-16632# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN 55. PART 3: MACHINERY DYNAMICS, SYSTEM IDENTIFICATION AND STRUCTURAL ANALYSIS Monthly Report
Jun. 1985 175 p refs Proceedings of the 55th Symposium on Shock and Vibration, Dayton, Ohio, 22-24 Oct. 1984; sponsored by ASD 3 Vol.
(AD-A160265; SVIC-Bull-55-Pt-3) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 01/3

This report is part 3 of a three volume set The Shock and Vibration Bulletin. It contains information on machinery dynamics, system identification and structural analysis. Symposium topics discussed include: an integrated gear system dynamics analysis overbroad frequency range; coupled torsional-flexural vibration of a geared shaft system using finite element analysis; structural damage detection by the system identification technique; time domain modal analysis of a slotted cylindrical shell; model evaluation of spinal injury likelihood for various ejection system parameter variations; time domain mathematical modeling of elastic instabilities and large elastic-plastic deflections and approximating dynamic response in small arrays using polynomials parameterization and response surface methodology. For individual titles, see N86-16633 through N86-16645.

N86-16633# Westinghouse Electric Corp., Sunnyvale, Calif.
AN INTEGRATED GEAR SYSTEM DYNAMICS ANALYSIS OVER A BROAD FREQUENCY RANGE
L. K. H. Lu, W. B. Rockwood, P. C. Werner, and R. G. DeJong (Cambridge Collaborative, Inc., Boston, Mass.) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 1-11 refs (For primary document see N86-16632 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

An integrated analytical scheme for Marine Gear System Dynamics is presented in this paper. The work can be divided into three parts: Gear excitation source prediction, response calculation in the low frequency range, and average response

estimation in the high frequency range. Various sources of gear mesh excitation are considered by Mark in his excellent analysis (1). However, for modern precision ground gears, the source of primary interest is likely to be that portion of the static transmission error whose frequency is the tooth meshing frequency. This is the case treated herein. In this work, the steady component of static transmission error and the first harmonic of mesh tone component of static transmission error are calculated from a solution of the mesh contact problem. A simplex algorithm proposed by Conry & Seirge (2) is used to solve the gear contact problem. Marine gear-turbine systems are comprised of individual components connected by bearings, mounts and gear tooth contacts. Methods best suited for response calculation of such a complex structure depend on the frequency range of interest as well as the properties of the methods. Author

N86-16634# Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.

COUPLED TORSIONAL-FLEXURAL VIBRATION OF A GEARED SHAFT SYSTEM USING FINITE ELEMENT ANALYSIS

S. V. Neriya, R. B. Bhat, T. S. Sankar *In* Shock and Vibration Information Center The Shock and Vibration Bulletin, Part 3 Jun. 1985 p 13-25 refs Sponsored in part by Natural Sciences and Engineering Research Council of Canada (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The coupled torsional-flexural vibration due to unbalance and geometrical eccentricity in the gears is studied. The coupling action is identified through the analysis of the gear motion and this effect is included in the finite element model of the system. The free vibration problem is solved to obtain the natural frequencies and mode shapes. Normal mode analysis is employed to obtain the dynamic response of the system to excitations arising from the mass unbalance and geometrical eccentricity in the gears. The response exhibits peaks not only at the system natural frequencies, but also at those frequencies which are related to the system natural frequencies through the gear ratio. The response spectra for various parametric combinations are presented and discussed. B.W.

N86-16635# Centre National de la Recherche Scientifique, Villeurbanne (France). Lab. de Mecanique des Structures.

INFLUENCE OF AN AXIAL TORQUE ON THE DYNAMIC BEHAVIOR OF ROTORS IN BENDING

R. Dufour, J. Dar Nagopian, and M. Lalanne *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 27-35 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Today it is necessary to predict with great accuracy the dynamic behavior of rotating machinery components at the design stage. This paper focuses on the secondary affect on the dynamic characteristics of rotors in bending, introduced by axial torque. The influence of a constant and an harmonic exciting torque has been studied both experimentally and theoretically in this work. Author

N86-16636# Memorial Univ. of Newfoundland, St. Johns. Faculty of Engineering.

SENSITIVITY ANALYSIS OF THE LOCATIONS OF THE BALANCING PLANES OF AN UNBALANCED ROTOR-BEARING SYSTEM USING DYNAMIC CONDENSATION TECHNIQUE

S. Abuja and A. N. Sharon *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 37-55 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

An analytical procedure for the dynamic balancing of multi-rotor systems supported on fluid-film bearings is presented. The model is developed based on the finite element method which includes the effects of translational, and rotational inertia, and gyroscopic moments using the consistent matrix approach in conjunction with the dynamic matrix reduction technique, the model analysis, and the least-square balancing techniques. The use of the matrix reduction technique for determining an equivalent reduced system for balancing, provides subsequent saving of both, the computational time and space, on the digital computer. Three distinct practical conditions are investigated in the present work which are: (1) the balancing of rotor disks at and below the critical speeds, (2) the effect of the location of the balancing planes on the rotor response, (3) the effect of the number of balancing planes on the rotor response. The balancing method is found to be quite effective, permitting safe rotor operation over the speed covering the three critical bending speeds. Author

N86-16637# Maryland Univ., College Park.

STRUCTURAL DAMAGE DETECTION BY THE SYSTEM IDENTIFICATION TECHNIQUE

J. C. S. Yang, T. Tsai, V. Pevlin, J. Chen, and W. H. Tsai *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 57-65 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20735 CSCL 20/11

The research described in this paper, concerns the development of techniques with the potential to detect and track progressive fracture by observing changes in the identified system parameters: mass, stiffness and damping matrix elements. The method, called the system identification technique, has two steps: a process of retrieving the eigenvalues and eigenvectors during a dynamic response phase and the determination of mass, stiffness and damping matrices from these values. The proposed techniques was verified on cantilever beam continuous structure systems through finite element simulation and experimental studies. Results from both studies have indicated the feasibility of damage detection by identifying the structural system matrices. For a cantilever beam system, the location of crack type damage seems to be best identified by the flexibility matrix which is the inverse of the stiffness matrix. B.W.

N86-16638# Wisconsin Univ., Madison. Dept. of Engineering Mechanics.

TIME DOMAIN MODAL ANALYSIS OF A SLOTTED CYLINDRICAL SHELL

W. Q. Fong, P. Q. Zhang, and T. C. Huang *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 67-79 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The modal parameters will change if a structure change from being perfect to being defective. This paper investigates a cylindrical shell with a longitudinal alot by the time domain method. The 11 sets of mode vectors, all of them nearly real modes, are investigated and the modal shapes are plotted. When the slotted shell is compared with the original perfect shell, it is found that several new mode vectors are created for the slotted shell, and the characteristics of the kept modes, the mode shapes of the perfect shell which remain for the slotted shell, will change also. Author

N86-16639# General Electric Co., Philadelphia, Pa. Space System Div.

APPLICATION OF THE ITD ALGORITHM TO LANDSAT TRANSIENT RESPONSES c18

R. R. Kauffman *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 81-89 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 22/2

Frequency, damping, and three degree-of-freedom mode shapes were estimated from data transmitted from the oribiting LANDSAT-4 and LANDSAT-5 Earth observation spacecraft. The data was comprised of three channels of time history data corresponding to orthogonal rotations of the spacecraft. The data was processed using the Ibrihim Time Domain Technique. It was

found that multiple modes could be characterized per channel of data. Damping estimates are on the order of 0.2% for low frequency (> 3 Hz) modes and on the order of 0.5% for high frequency modes. Author

N86-16640# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.

THE IDENTIFICATION MATRIX AND CONVERGENCE OF PARAMETERS IN OFF-LINE SYSTEM IDENTIFICATION

Ken Tomita and Darrell A. Frohrib *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 91-97 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 02/11

The identification matrix characterizes the mathematical properties of a system's model in conjunction with an identification algorithm; uniqueness of obtained system parameters is guaranteed. The identification matrix is the second partial derivative of an error criterion with respect to system parameters. The matrix can be reformulated as part of the identification algorithm based on the least square identification concept. The identification matrix also relates least square identification to output distinction identifiability. Numerical examples of these roles of the identification matrix are presented. Author

N86-16641# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

MODEL EVALUTION OF SPINAL INJURY LIKELIHOOD FOR VARIOUS EJECTION SYSTEM PARAMATER VARIATIONS c52

Eberhardt Privitzer *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 99-115 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 06S

The Air Force Aerospace Medical Research Laboratory's (AFAMRL) Head-Spine Model (HSM), a discrete element model of the human head-spine structure, is described. This model was developed to provide a mathematical means for the investigation of three-dimensional head-spine structure dynamic response and injury likelihood in impact environments and to serve as a design tool for the evaluation of crewmember-ejection system impact interactions. Results are presented from a study which involved the use of the HSM to evaluate the effects of variations in certain ejection system parameters on head-spine structure ejection response and injury likelihood. Author

N86-16642# Franklin Research Center, Philadelphia, Pa.

TIME DOMAIN MATHEMATICAL MODELING OF ELASTIC INSTABILITIES AND LARGE ELASTIC-PLASTIC DEFLECTIONS

Robert P. Brooks *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 117-127 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Mathematical modeling and computational techniques, based on an explicit time integration scheme, are presented for the calculation of elastic instabilities and large elastic-plastic deflections of beam elements. The equations are formulated to facilitate their introduction into time-domain computer programs. The simple models presented, demonstrate the phenomena for Euler, angle and lateral buckling, as well as plastic-buckling with strain-rate effects. This methodology can be implemented to analyze complex structures, consisting of members that may exhibit failure instability when subjected to large, short-duration loads. Author

N86-16643# Indian Space Research Organization, Bangalore. Structures Div.

LOW ORDER DYNAMIC MODELS OF INDIAN REMOTE SENSING SATELLITE c18

M. Sambasiva Rao, B. G. Prakash, and M. S. S. Prabhu *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 129-153 (For primary document see N86-16632 07-39)

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Simple low order equivalent dynamic models of Indian Remote Sensing Satellite (IRS) are generated. The models consist of physical elements like springs, beams, etc., with lumped masses. Two decoupled models, one in longitudinal and the other in lateral direction, are generated representing the dynamic characteristics of the satellite adequately in the low frequency range of 0 to 100 Hz. A building-block approach is followed in systematically constructing the models. First, conceptual models are generated based on the study of load paths, models of vibration etc., from a detailed finite element analysis of IRS already made. The important spacecraft subsystem models are derived by simulating their base-fixed modes of interest using equivalent physical single degree of freedom systems by matching the frequencies and modal effective masses. This required a new approach in representing subsystems with multi-node interfaces for their equivalent masses and forces. Lastly the subsystem models are assembled and interface elements are tuned to match with the basic dynamic behavior of IRS as observed from detailed finite element analysis. B.W.

N86-16644# Tsinghua Univ., Beijing (China).

A DIRECT METHOD FOR ESTIMATING LOWER AND UPPER BOUNDS OF THE FUNDAMENTAL FREQUENCY

Dewen Jin, Walter D. Pilkey (Virginia Univ., Charlottesville), B. P. Wang (Texas Univ., Arlington), and Yohji Okada (Ibaraki Univ., Hirachi, Japan) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 155-165 refs Sponsored in part by ONR, Arlington, Va. (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

When studying or designing a vibrating system, it is useful to have a quick estimate of frequencies, especially the fundamental frequency. The lower and upper bounds of the fundamental frequency provide the approximation and range of this frequency. This paper presents a direct method to get the lower and upper bounds of a fundamental frequency. In contrast to currently used approaches, the lower and upper bounds can be obtained simultaneously by this method. The method is applicable to discrete and continuous systems. For discrete systems this procedure involves substituting an assumed mode shape into the equations of motion, and then the bounds of the fundamental frequency are obtained by the enclosure theorem. For continuous systems, an initial distributed load is assumed instead of an initial modeshape. A simple formula for estimating the bounds of the fundamental frequency of a continuous beam is derived in this paper. This technique is especially appropriate for a system having a first modeshape which is easy to estimate. Several examples are presented to illustrate the method. Author

N86-16645# Virginia Univ., Charlottesville. School of Engineering and Applied Science.

APPROXIMATING DYNAMIC RESPONSE IN SMALL ARRAYS USING POLYNOMIAL PARAMETERIZATIONS AND RESPONSE SURFACE METHODOLOGY

K. P. White, Jr., H. C. Gabler, III, and W. D. Pilkey *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 167-173 refs (For primary document see N86-16632 07-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

This paper describes a method for deriving an approximate algebraic model which defines the performance of a dynamic system as a function of its response parameters. The method extracts essential response information from large amounts of test data or simulation output and stores this information in a single, small, two-dimensional array. This data compression provides for highly efficient storage of essential information in a form which is especially convenient for subsequent use in analysis, experimenta-

tion, model validation, or design optimization. The method is illustrated by an application to passenger-vehicle crashworthiness design optimization. Author

N86-16646# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN 55. PART 2: DYNAMIC TESTING, FLIGHT VEHICLE DYNAMICS, SEISMIC LOADS AND FLUID-STRUCTURE INTERACTION Monthly Report
Jun. 1985 202 p refs Proceedings of the 55th Symposium on Shock and Vibration, Dayton, Ohio, 22-24 Oct. 1984; sponsored by ASD 3 Vol.
(AD-A160264; SVIC-Bull-55-Pt-2) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 01/3

Several topics related to dynamic testing, flight dynamics, seismic loads, and fluid-structure interaction are discussed. Shock waves, earthquakes, impact tests, blast loads, aircraft reliability, ship hulls, and submerged bodies are among the topics covered. For individual titles, see N86-16647 through N86-16662.

N86-16647# Pacific Missile Test Center, Point Mugu, Calif.
TRIAXIAL VIBRATION SYSTEM
W. Douglas Everett and Thomas H. Helfrich *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 1-15 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

During the reliability tests of external stores the Pacific Missile Test Center has been successful in reproducing the in-service vibration experienced by the store when carried on a high performance jet aircraft. A combination of acoustic and mechanical excitation provides the appropriate vibration magnitude and spectrum. One of the advantages of using acoustic energy has been the simulation of the vibrational state simultaneously in three axes. In attempting to increase test capability to include stores carried on helicopters and other low speed platforms and to maintain a triaxial vibration capability, Pacific Missile Test Center is developing a test facility that will test a 500 pound store in the 0 to 500 Hertz frequency range with a stroke of 2 inches double amplitude. A review of existing low frequency triaxial vibration equipment was conducted, a preliminary design was completed, and individual component and initial developmental model tests were concluded. A description of the device, an overview of the effort to date, an analytical investigation of the motion, and an evaluation test plant was developed for a thorough evaluation of the device are discussed. Author

N86-16648# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
INITIAL DESIGN AND TESTING OF A UNIQUE HIGH FREQUENCY FATIGUE TEST SYSTEM
David I. G. Jones *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 17-26 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The development of a high-frequency resonant fatigue test system for investigating crack intiation and propagation behavior in test specimens under combined low cycle (LCF) and high cycle (HCF) loading is described. The system offers significant advantages in low coat and simplicity. Initial dynamic response predictions for the prototype system are discussed. Comparisons with experimental measurements are made. Plans for improvement and implementation of the system are briefly discussed. Author

N86-16649# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
INVESTIGATION OF MODES, FREQUENCIES AND FORCED RESPONSE OF A HIGH FREQUENCY FATIGUE TEST SYSTEM
Dantam Rao and David I. G. Jones *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 27-37 refs Sponsored in part by National Academy of Sciences - Natioal Research Council, Washington, D.C. (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A low cost, resonance based Fatigue Test System Prototype, designed for studying the crack-growth rates of turbine or disc blade materials under the combined action of a High Cycle Fatigue Load (HCF) and Low Cycle Fatigue Load (LCF), has been fabricated by the Materials Laboratory. Theoretical and experimental analysis of dynamic characteristics of this prototype structure are presented. The theoretical investigation of natural frequencies and modes is carried out by the finite element method using planar and solid elements available in NASTRAN. The experimental tests are conducted using a micro-computer based system STEPSINE (which plots the frequency response function in real time), with the HCF/LCF machine excited by stepped sine excitation. Accelerance response of the structure is also measured by a commercial dual channel FFT analyzer. The natural frequencies calculated by the finite element model are compared with experimental values measured by the STEPSINE system and FFT Analyzer. Factors affecting the accuracy and quality of the dynamic characteristics obtained by using these three methods are discussed. Author

N86-16650# Hughes Aircraft Co., Albuquerque, N. Mex. Engineering Center.
DATA ANALYSIS TECHNIQUES TO SUPPORT STRUCTURAL MODELING
J. W. Jeter and P. H. Merritt *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 39-49 refs (For primary document see N86-16646 07-39)
(Contract F29601-83-C-0042)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Finite element structural analysis of a complex system is generally restricted by the size of a structural model which can be realistically included in a computer analysis. Furthermore, practical problems are often lacking a definitive representation of the significant input for the model. The use of coherence analysis to attach both the problem of model complexity and the problem of input definition is discussed. The techniques utilized for simple and multiple coherence analysis are described, examples are presented, and the effects of the techniques on a practical analysis are discussed. The procedure has advantages which are applicable to most large scale applications of finite element modeling techniques. Author

N86-16651# Sandia National Labs., Albuquerque, N. Mex.
ULTRA-HIGH-VELOCITY IMPACTS UTILIZING A ROCKET SLED AND AN EXPLOSIVELY ACCELERATED FLYER PLATE c14
R. A. Benham and W. R. Kampfe *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 51-55 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/2

Well-controlled impacts of reentry vehicle nose tips with relatively thick targets at controlled inclination and at velocities above 14,000 fps can now be obtained using a newly developed testing method. The instrumented nose tip is mounted on a rocket sled and is accelerated to a velocity of more than 6000 fps. An explosively accelerated flyer plate (target) is driven toward the sled, at the proper angular orientation, at velocities of more than 8000 fps. Impact of the target and nose tip occurs at the combined velocities. Precise timing is required to produce the desired impact conditions and impact diagnostic information as well as output from the onboard instrumentation system. This method has been demonstrated in two experiments, with total test costs a fraction of that of the only other alternative-a rocket flight test. Author

N86-16652*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WATER IMPACT TESTING OF A FILAMENT WOUND CASE
A. A. Schmidt and D. A. Kross *In* Shock and Vibration Information Center The Shock and Vibration Bulletin, Part 2 Jun. 1985

p 57-67 ref (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 23075 CSCL 20/11

A lightweight Filament Wound Case (FWC) Solid Rocket Booster (SRB) is being developed by NASA to increase the payload capability of the space shuttle. As with the steel boosters, the current plan is to recover the FWC SRB's after they impact the ocean at 65 to 85 ft/sec. As the boosters enter the ocean (nozzle first) the water moves away from the vehicle creating a cavity, which then collapses on the vehicle, and results in a significant loading event. To understand this loading event, tests were conducted on a quarter scale FWC model to measure cavity collapse pressure distributions, deflected shape and the effects of end conditions and pressure scaling. Author

N86-16653# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIRWORTHINESS FLIGHT TEST PROGRAM OF AN AIRCRAFT EQUIPMENT FAIRING **c05**
V. R. Miller and T. P. Severyn (4950th Test Wing, Wright-Patterson AFB, Ohio) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 69-75 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 01/3

The results of an airworthiness flight test program of an aircraft equipment fairing are given. The objective of the tests was to insure the airworthiness of the aircraft with the installed fairing. The tests were conducted to determine the structural integrity of the modifications and their effects on the aircraft handling qualities. The tests were extended to allow more detailed data acquisition and analysis due to the problems encountered with flow separation, aerodynamic buffeting and noise-induced fatigue. The test indicated that the airspeed envelope of the aircraft be restricted while the fairing was installed, and that structural modifications to portions of the aircraft be made. Rigid inspection requirements were levied after each flight to detect any structural damage. Author

N86-16654# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN UPDATE OF SPACECRAFT DYNAMIC ENVIRONMENTS INDUCED BY GROUND TRANSPORTATION **c18**
N. R. OConnell *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 77-85 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 22B

An update to a spacecraft transportation dynamic environments data base was developed based on data from recent transportation of spacecrafts. Vibration levels are significantly lower than those measured in 1966, while the shock response spectra are nearly the same. Ground shipping criteria and shipping practices, which have been very successful in preventing damage, are also summarized. Author

N86-16655# Illinois Inst. of Tech., Chicago. Dept. of Civil Engineering.
RELIABILITY OF STRUCTURES SUBJECTED TO MULTIPLE BLAST LOADS
A. Longinow, J. Mohammadi, and H. S. Napadensky (Illinois Inst. of Technology Research Inst., Chicago) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 87-93 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The problems involved in predicting the response of structures when subjected to multiple blast loads are examined. In this formulation the structure is modeled as a single degree of freedom system with a resistance function which provides for an approximate degradation in its strength. The method considers uncertainties in both structural and blast load parameters. The blast load and resistance are assumed to be lognormally distributed. A failure probability is computed after each blast. Individual failure probabilities are combined to yield the probability of collapse. The method of analysis is described. Its application is illustrated by means of an example problem. Its limits of applicability and needs for further research are described. Author

N86-16656# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DEVELOPMENT OF A SHEAR STATIC CALIBRATION DEVICE
Charles D. Little, Jr. *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 123-127 (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The definition of increasingly severe dynamic test environments from explosive laodings for defense and military structures has required pressure and stress measurements on the order of several kilobars. To facilitate these measurements a static fluid calibration device was developed which enables transducer calibration to the 3 kbar pressure level. The device is constructed of high-strength steels and is a totally self-contained unit, needing no further means for confinement. The strength and stiffness of the device is sufficient for safe and routine loading of areas up to 64.5 square centimeters (10 in.) for the rare working pressure. The hydraulic system is composed of a hand operated, low volume pump, stainless steel tubing, check valves, fittings, and an input pressure gage, all of which are nominally rated at 7 kbar. Transducers with body thicknesses ranging from 2.54 to 8.89 cm (1 to 3.5 in.) and diameters from 0.89 to 12.7 cm (3.5 to 5 in.) are accomodated by the present design. In addition to transducer calibration, the device provides a useful vehicle for experimental transducer varification through determination of nonlinear and hysteretic effects. Author

N86-16657# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
D'ALEMBERT UNFOLDING OF HOPKINSON BAR AIRBLAST DATA
Howard C. White and Charles R. Welch *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 129-133 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Strain gaged Hopkinson Bars are being used to make airblast impulse measurements in high pressure (172 MPa (25 ksi) to 621 MPa (90 ksi)) explosive environments. The data obtained are researchers typically limited in time by the arrival of the reflected tensile wave from the dump end of the bar. For a bar 5.8 m (19 ft) long with a dump section of 4.0 m (13 ft), the record is approximately 1.6 msec long before the reflected wave is seen in the data. By manipulating that portion of the data that is effected by reflections, researchers can increase the useful data time length by a factor of two to four. A simple data unfolding procedure based on an elastic D'Alembert solution for stress waves in a bar is presented. Bar gage airblast data unfolded using this procedure and the impulse data from these records are also presented. Author

N86-16658# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DESIGN AND FIELD EXPERIENCE WITH THE WES 10 PERCENT BAR AIRBLAST AND SOIL STRESS GAGE **c35**
Charles E. Joachim and Charles R. Welch *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 135-147 (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 14/2

A family of shock transducers based on the classical load-cell geometry, i.e., the elastic compression of a column, is currently under development at the waterways Experiment Station. The transducers include an airblast gage, a soil stress gage, and a

soil-structure interface stress gage. These gages operate at considerable higher pressure ranges than previous elastic shock transducers. The airblast gage has provided long term (over 10 msec) measurements in blast environments of over 600 MPa (6 kbar). The theoretical operating pressure range of the gages is approximately 1000 MPa (10 kbar) limited by the elastic limit of the gage body steel. The actual pressure range to date has been limited by acceleration induced failures of the strain gages and internal wiring. The transducer development, is described and some dynamic measurements produced from these gages are given. Author

N86-16659# Defence Research Establishment Suffield, Ralston (Alberta).
STRUCTURAL RESPONSE OF PANELS SUBJECTED TO SHOCK LOADING
R. Houlston and J. E. Slater *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 149-163 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

In combat operations, warships could be subjected to air blast and underwater shock loads capable of causing significant local damage. As part of a vulnerability and survivability study, the prediction and measurement of the structural response of ship panels to free field airblast explosions are investigated. Experiments with steel plates and a full scale stiffened panel are described in detail. Finite element modeling results are presented with a detailed correlation to experiment. Author

N86-16660# Naval Underwater Systems Center, Newport, R.I.
GENERALIZED DYNAMIC ANALYSIS OF INTERACTIVE FLUID-STRUCTURE TRANSIENT RESPONSE
J. E. Boisvert and B. E. Sandman *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 165-171 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A generalized classical analytical method is formulated for the solution to the response of submerged structures excited by transient forces. The approach is directly applicable to numerous problems where transient structural response in the presence of a heavy fluid medium is of fundamental interest. The proposed methodology, which captures the complete spectral distribution of frequency and wavenumber, is capable of describing response to unlimited space-time waveforms of transient loading. The methods employed in the development of a generalized analytical approach utilize a complete basis of functional influence coefficients in both the space and time domains. These influence functions are generated in terms of a series summation which represents the response under space-time impulses. Subsequently, a convolution integral of the actual space-time input distribution function with the influence functions provides the final resolution to the in-fluid structural response under any chosen or described form of the input loading. The implementation of this analytical approach is achieved without employing asymptotic assumptions or approximations of the relative fluid loading. The form of the analytical approach is directly applicable to the solution of submerged, transient response of any structure which can be characterized in terms of generalized, in-fluid dynamic influence functions. Author

N86-16661# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
ON THE FIELD EXPERIENCES OF UNDERWATER TESTING FOR A STIFFENED FLAT PLATE MODEL
T. R. Rentz and Y. S. Shin *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 173-191 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

An experimental investigation into the underwater shock-induced responses of a stiffened flat plate was conducted. An air-backed flat plate with externally machined rectangular stiffeners and a clamped boundary condition was subjected to shock wave loading by an eight pound TNT charge detonated underwater. The plate was instrumented to measure transient strains. The test structure acceleration and free field pressure were also measured. Pre-shot and post-shot calculations were performed using the EPSA (Elasto-Plastic Shell Analysis) code. Many lessons were learned and important factors to be considered in the testing are discussed. Author

N86-16662# Naval Ship Research and Development Center, Portsmouth, Va. Underwater Explosions Research Div.
ANALYSIS OF CAVITATION CAUSED BY SHOCK WAVE INTERACTION WITH A RESTRAINED MASS
Robert T. Handleton *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 2 Jun. 1985 p 193-203 refs (For primary document see N86-16646 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A method for obtaining the motion of a restrained mass loaded by an underwater shock wave is developed through an analysis of the opening and closing of cavitation at the mass. Without making energy assumptions beforehand, the derived motion of the mass is used to calculate the fraction of the incident shock wave energy absorbed by the restraint over a range of parameters. The energy study provides a basis for judgements of the fraction of incident energy absorbed by a yielding surface. Author

N86-16663# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
STRESS INTENSITY FACTORS AT RADIAL CRACKS OF UNEQUAL DEPTH IN PARTIALLY AUTOFRETTAGED, PRESSURIZED CYLINDERS Final Technical Report
S. L. Pu Jun. 1985 31 p
(AD-A157866; AD-E440288; ARLCB-TR-85018) Avail: NTIS HC A03/MF A01 CSCL 20/11

Stress intensity factors are estimated for radial cracks of unequal depths emanating from the inner surface of a partially autofrettaged cylinder subjected to various bore pressures. The approximate method developed for uneven radial cracks in a non-autofrettaged cylinder is applied to functional stress intensities. Linear superposition is then used to obtain the final stress intensity factors of uneven cracks due to a stress field which varies with the magnitude of bore pressure, the degree of autofrettage, and the elastic-plastic behavior of the cylinder material. The autofrettage residual stress reduces the level of stress intensity factors at inner radial cracks due to internal pressure, but has little effect on variations in stress intensity factors caused by changes in crack depth. GRA

N86-16664# Washington Univ., Seattle. Dept. of Mechanical Engineering.
DYNAMIC FRACTURE TOUGHNESS
A. S. Kobayashi, M. Ramulu, M. S. Dadkhah, K. H. Yang, and B. S. J. Kang Aug. 1985 26 p
(Contracts N00014-85-K-0187; N00014-76-C-0060)
(AD-A159382; UWA/DME/TR-85/53) Avail: NTIS HC A03/MF A01 CSCL 11/6

Dynamic fracture toughness versus crack velocity relations of Homalite-100, polycarbonate, hardened 4340 steel and reaction bonded silicon nitride are reviewed and discrepancies with published data and their probable causes are discussed. Data scatter in published data are attributed in part to the observed fluctuations in crack velocities. The results reaffirmed our previous conclusion that the dynamic fracture toughness versus crack velocity relation is specimen dependent and that the dynamic arrest stress intensity factor is not a unique material property. GRA

N86-16665# Air Force Systems Command, Wright-Patterson AFB, Ohio.
SOFTWARE FOR NUMERICAL CALCULATION OF TWO-DIMENSIONAL NONSTATIONARY FLUID ELASTICITY AND PLASTICITY PROBLEMS

M. Z. Qin, C. S. Xie, Q. M. Tan, and X. P. Lin 27 Aug. 1985 20 p Transl. into ENGLISH from Jisuan Yu Jisuanji Yingyong (China), v. 5, no. 3, 1984 p 129-137
(AD-A159392; FTD-ID(RS)T-0495-85) Avail: NTIS HC A02/MF A01 CSCL 20/11

This paper uses the HELP code to compile a LTDL program in BCY language. It is capable of solving plasticity and elasticity problems of a two dimensional nonstationary fluid (planar or axisymmetry problems), including multi-materials (metals and nonmetals). A great deal of calculation was performed to solve problems such as metal projectile penetration into steel target, high speed collision, surface explosion of high energy explosive, spherical explosion, collision of two rods, etc. Very useful results were obtained. This paper describes the capabilities and focal points of this software. GRA

N86-16666# Lawrence Livermore National Lab., Calif.
EVALUATION OF TEARING ENERGIES IN STYRENE-BUTADIENE RUBBERS
A. Goldberg, D. R. Lesuer, J. C. Stone, and J. Patt 25 Jun. 1985 63 p Prepared in cooperation with Army Tank-Automotive Command, Warren, Mich.
(Contract W-7405-eng-48)
(DE85-013240; UCID-20502) Avail: NTIS HC A04/MF A01

Tearing energies were obtained on samples removed from commercial tank-track pads and on a series of SBR laboratory formulations in which the carbon-black content varied from 0 to 40 wt %. The commercial materials were tested at a strain rate of 10/s with temperatures ranging from 22 to 140 C. The laboratory materials were tested also at both lower and higher strain rates and at -20 C. We evaluated the effect of temperature, strain rate, and carbon-black content on tearing energy, failure stress, and failure strain. The results, including the shape of the stress-strain curves, are discussed in terms of viscoelasticity, uncoiling of the long molecular chains, carbon-black rubber interactions, and knotty tearing. In the absence of knotty tearing and for carbon-black contents of 20 wt % or less the tearing energy, the failure stress, and failure elongation increased with either a decrease in temperature or an increase in carbon-black content. With the first appearance of knotty tearing, which occurred at 20 to 25 wt % carbon black, large increases in tearing energy and failure strength were obtained. DOE

N86-16667# Los Alamos National Lab., N. Mex.
THERMOELASTIC-PLASTIC FLOW AND DUCTILE FRACTURE IN SOLIDS
D. L. Tonks 1985 63 p
(Contract W-7405-eng-36)
(DE85-015699; LA-UR-85-2529) Avail: NTIS HC A04/MF A01

The main aim of these lectures is to develop the theory of elastic-plastic flow in solids, with application to a particular class of processes, namely those in which the dissipation of plastic work cannot be neglected. Examples of such processes are highspeed impact phenomena and cratering, shock compression, often shock release as well, and explosive deformation and welding. An important part of the development is to include the anisotropic elastic properties of a solid, and for this reason the theory applies to solids in general. On the other hand, it is possible that some of the results will have limited validity for nonmetals. The secondary aim of the lectures is to develop a general framework for ductile fracture, and describe the current practice in the field. Our theory is incremental in nature and suitable for integrating along a process in small timesteps as is done in hydrodynamic computer programs. A notational conflict arose, because in continuum mechanics the extensive quantities are taken per unit mass, while in thermodynamics they are usually per unit volume. The continuum mechanics normalization, i.e., per unit mass, is used throughout, with the result that uncommon factors of density show up in the thermodynamic equations. DOE

N86-16668# Los Alamos National Lab., N. Mex.
DECONVOLUTION ANALYSIS TO DETERMINE RELAXATION TIME SPECTRA OF INTERNAL FRICTION PEAKS
J. R. Cost 1985 5 p Presented at the Conference on Internal Friction and Ultrasonic Attenuation in Solids, Urbana, Ill., 3 Jun. 1985
(Contract W-7405-eng-36)
(DE85-015702; LA-UR-85-2504; CONF-8506125-5) Avail: NTIS HC A02/MF A01

A new method for analysis of an internal friction vs temperature peak to obtain an approximation of the spectrum of relaxation time responsible for the peak is described. This method, referred to as direct spectrum analysis (DSA), is shown to provide an accurate estimate of the distribution of relaxation times. The method is validated for various spectra, and it is shown that: (1) it provides approximations to known input spectra which replicate the position, amplitude, width and shape with good accuracy, (2) it does not yield approximations which have false spectral peaks. DOE

N86-16669# Brookhaven National Lab., Upton, N. Y. Structural Analysis Div.
LIQUID STORAGE TANKS UNDER VERTICAL EXCITATION
A. J. Philippacopoulos 1985 6 p Presented at a conference
(TI85-012188; BNL-NUREG-36472; CONF-850670-19) Avail: NTIS HC A02/MF A01

Until recently, the hydrodynamic effects on liquid storage tanks induced by an earthquake excitation were basically treated for the horizontal component of the earthquake. Recent studies, however, showed that the hydrodynamic effects due to the vertical component of an earthquake may be significant. In these studies the tank is assumed to be fixed at the bottom. The hydrodynamic behavior of liquid storage tanks induced by vertical earthquake input excitation is discussed. First, the fluid-tank system is treated as a fixed-base system and a single formula is obtained for the coupled fluid-structure natural frequency. Second, additional interaction effects due to the foundation flexibility on the fluid-tank system are investigated. It is concluded that the foundation flexibility may have a significant effect on the hydrodynamic behavior of the liquid storage tanks under a vertical ground shaking. DOE

N86-16670# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
INTERNAL-VARIABLE BASED MODELS FOR ELEVATED TEMPERATURE FATIGUE AND DEFORMATION Annual Progress Report, 1 Jul. 1984 - 31 Jan. 1985
A. K. Miller 1985 116 p
(Contract DE-FG03-84ER-45119)
(DE85-014322; DOE/ER-45119/T1) Avail: NTIS HC A06/MF A01

This project addresses a major need within high-temperature, materials-limited energy technologies, namely, the need for science-based models which can predict deformation and fracture of the major component materials. These models, in turn, are necessary for evaluations of new alloys, for design optimization studies, and for demonstrations that the systems meet safety and reliability criteria. DOE

N86-16671# Lawrence Livermore National Lab., Calif.
VIBMAIN: ONE-DIMENSIONAL VIBRATION
C. Calder 1 Jul. 1985 47 p
(Contract W-7405-eng-48)
(DE85-017396; UCID-30200-83-7) Avail: NTIS HC A03/MF A01

A first engineering course in vibration is traditionally taught at the senior level and deals with the theory and concepts of a one-dimensional vibration system. Course content begins with free vibration of undamped and viscously damped systems. Coulomb-type (friction) damping is typically given only a cursory treatment because of the difficulty inherent in the discontinuous, passive friction force. Applied forcing functions are studied next beginning with harmonic functions followed by transient force inputs. In the study of transient forces, various numerical methods are typically introduced. The purpose of the code described here is to provide a numerical of solving all of the one-dimensional problems normally encountered in a vibrations course. This includes the classical problems which can be solved in closed-form but is especially directed at solutions for problems which might contain Coulomb

damping, nonlinear springs, a general forcing function, and/or base-excitation input. The code also serves to introduce the user to the power on numerical techniques and microcomputers in computer-aided engineering. The graphical output gives a clear picture of the dynamic response and illustrates the mathematical relationship between displacement, velocity, and acceleration. DOE

N86-16672# Los Alamos National Lab., N. Mex.
SCATTERING OF ELASTIC WAVES BY SMALL SURFACE-BREAKING OR SUBSURFACE CRACKS IN THREE DIMENSIONS
W. M. Visscher 1985 10 p Presented at the Review of Progress in Quantitative NDE, Williamsburg, Va., 23 Jun. 1985
(Contract W-7405-eng-36)
(DE85-017564; LA-UR-85-2840; CONF-8506110-2) Avail: NTIS HC A02/MF A01

The long-wavelength limit of elastic wave scattering by surface cracks in 3D is considered. It is shown that, if the crack is normal to the surface, the scattering can be described by two real parameters, one of which may be taken to be the crack size. The other therefore depends on shape, orientation, and burial depth. Many computed illustrations are given. It is concluded that the amount of information about cracks obtainable by low frequency elastic wave scattering is very limited. DOE

N86-16673# Rolls-Royce Ltd., Derby (England). X-Ray Diffraction Lab.
X-RAY RESIDUAL SURFACE STRESS MEASUREMENT IN AERO ENGINE MATERIALS
C. Baxter and K. Swift 23 Jul. 1985 26 p Presented at BSSM X-Ray Stress Group, Wolverhampton, England, 30 Apr. 1985
(PNR-90274) Avail: NTIS HC A03/MF A01

Critical elements of gas turbine engines such as nickel based superalloy turbine disks were examined by X-ray diffraction. A software package was developed. The program generates data in a tabular form. The data can be plotted on a suitable scale for visual peak assessment. Several routine choices are possible, including selection of a window for detailed analysis, removal of background, application of Lorentz, polarization and absorption correction factors, and evaluation of the slope of the plot by a least squares fit routine and use of this to calculate the residual elastic stress. Author (ESA)

N86-16674# Welding Inst., Cambridge (England).
FATIGUE TESTING OF TUBE TO NODE BUTT WELDS ENVISAGED FOR RAE BEDFORD FLIGHT SIMULATOR
T. D. Rosenberg Apr. 1985 30 p refs Prepared for Vickers PLC, Hampshire, England
(Rept-23480/2/85; BR95858) Avail: NTIS HC A03/MF A01

Fatigue tests were carried out on tube to node butt welds under axial loads. Results indicate that the joints can be treated as Class F in the BS 5400 fatigue design rules for welded joints. Pressure drop and leak detection systems for crack detection during the operation of the structure were evaluated. The pressure drop system is found to be effective in detecting the presence of through-thickness cracking. The reserve static strength of a joint containing a single through-thickness crack was measured, and found to be equivalent to a nominal stress in excess of the yield strength of the parent material. Author (ESA)

N86-16675# Admiralty Marine Technology Establishment, Teddington (England).
COMPUTATION OF POWER FLOW IN POINT CONNECTED DYNAMICAL SYSTEMS
J. H. James Jul. 1985 14 p refs
(AMTE(N)-TM-85066; BR96713; AD-A159556) Avail: NTIS HC A02/MF A01

Power input by time-harmonic forces and power dissipated in a component subsystem are found from the displacements and reaction forces which are obtained numerically by a computer program for dynamic stiffness coupling. Power flow in a system consisting of a finite beam mounted on an infinite water loaded plate is given as a numerical example in order to demonstrate the usefulness of the program as a research tool for power flow calculations. Author (ESA)

N86-16676# Technical Research Centre of Finland, Espoo. Metals Lab.
MECHANICAL PROPERTIES OF SHIELDED METAL ARC (SMA) AND SUBMERGED ARC (SA) WELDED JOINTS FOR QUENCHED AND TEMPERED HIGH STRENGTH STEEL N-A-XTRA-70
Maretti Vilpas, Hannele Tihekari, and Risto Karppi Sep. 1985 29 p refs Sponsored by Finnish Ministry of Trade and Industry
(VTT-363; ISBN-951-38-2402-0; ISSN-0358-5077) Avail: NTIS HC A03/MF A01

Hardness, tensile and Charpy-V testing, and fracture mechanics results of shielded metal arc and submerged arc welded joints for quenched and tempered high-strength steel N-A-XTRA-70 (Ste 690) are given. Results for joints welded with Ni-Cr-Mo alloyed filler materials using arc energies of 17 kJ/cm and 30 kJ/cm and preheat temperature of 170 C show that the weld metal strength and toughness properties are close to the base material values. Hardness varies in the range 278 to 337 HV5 for the weld metals and 295 to 476 HV5 for the heat affected zones of the joints. Weld metals show reasonably good transition behavior compared with the base material. Arc energy has no marked effect on the KJ transition behavior of the welds. Author (ESA)

N86-16677# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Werkstofftechnologie.
APPLICATION OF THE dc POTENTIAL DROP AND THE PARTIAL UNLOADING METHODS TO FRACTURE MECHANICS TESTS
J. Heerens, K.-H. Schwalbe, D. Hellmann, J. Knaack, and J. Mueller-Roos 1985 47 p refs Extended version of paper presented at ASTM Symposium on User's Experience with Elastic-Plastic Fracture Throughness Test Methods, Louisville, Kentucky, 20-22 1983 Sponsored by Deutsche Forschungsgeimschaft
(GKSS-85/E/16; ISSN-0344-9629) Copyright. Avail: NTIS HC A03/MF A01

The ability of the dc potential drop method and the partial unloading technique to measure crack growth and to detect initiation of crack growth was investigated using steels and aluminum alloys. It is found that both the methods can be recommended for the determination of the R-curve; however, at small amounts of crack growth the dc potential drop method gives more consistent results. The initiation values Jo of J determined by fractography were compared with Jlc as obtained by current practice. It is found that Jlc is poorly related to initiation or to a specific amount of crack growth. A modification of the Jlc procedure is proposed. Two contacting arrangements of the dc potential drop method were checked for initiation detection. Author (ESA)

N86-16678# Materials Quality Assurance Directorate, London (England). Materials Center.
STRESS-CRACKING OF POLYMETHYL METHACRYLATE BY POLYETHYLENE GLYCOLS OF DIFFERENT MOLECULAR WEIGHTS
S. Millington Mar. 1985 17 p refs
(MQAD-TP-893; BR95960) Avail: NTIS HC A02/MF A01

The critical strains of polymethyl methacrylate in contact with polyethylene glycols were measured using a constant strain method. It is found that the critical strain depends on the difference between the solubility parameters of the glycol and the polymer. The times to craze are shown to depend on the competing effects of molecular size and solubility parameter. Author (ESA)

N86-16679# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
AN EXPLORATIVE INVESTIGATION INTO NECKING PHENOMENA
E. vanderGiessen Sep. 1983 133 p refs
(Lab-Rept-754) Avail: NTIS HC A07/MF A01

Theoretical, numerical, and experimental aspects of necking phenomena in tensile tests are discussed. Using a fully abstract notation of vectors and tensors, foundations of nonlinear continuum mechanics, especially finite strain plasticity, are derived. The bifurcation problem governing the onset of axisymmetric necking in a circular cylindrical tube, made of an incompressible, isotropic hardening material, in uniaxial tension is analyzed. Necking in tubular specimens is studied numerically. The relatively stiff ends appear to have a considerable influence on the entire deformation history. The effect of compressibility together with kinematic hardening on necking in a plane strain tensile bar is studied numerically. Alternatives for the experimental analysis of necking phenomena are discussed. The applicability of elementary grid methods is limited by the ductility of the grid material.
Author (ESA)

N86-16680# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
THE INFLUENCE OF OBLIQUE PLATE EDGES ON STRESS DISTRIBUTION [DE INVLOED VAN SCHEVE RANDEN AAN PLATEN OP DE SPANNINGSVERDELING]
E. vanderGiessen Oct. 1983 48 p refs In DUTCH
(Lab-Rept-756) Avail: NTIS HC A03/MF A01

The effect of free, oblique plate edges on the stress and deformation distribution in the neighborhood of such edges was studied. The torsion of a very broad plate strip with oblique edges was considered. Using the perturbation method an approximate solution of the torsion problem is established in the form of two (repeated) asymptotic series in the maximum deviation with respect to the straight edge and in the wavelength of the evolution of the edge. If in the neighborhood of the edge a relative error with respect to the plate theory solution is allowed, three corrections to that solution are found. These three corrections have a boundary layer character and take into account that the edge is free of stress, that the free edge is not perpendicular to the midplane, and that the position of the free, oblique edge is not constant along the edge of the plate. Author (ESA)

N86-16681# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
AN APPROXIMATE CALCULATION OF HORIZONTAL CIRCULAR-CYLINDER PRESSURE VESSELS SUPPORTED BY RINGS. PART 1: REPORT [HORIZONTALE DRUKVATEN. EEN BENADERINGSBEREKENING VAN HORIZONTALE CIRKELCILINDRISCHE DRUKVATEN OP ONDERSTEUNINGSRINGEN. DEEL 1: RAPPORT]
G. D. vanderWeijde Oct. 1983 127 p refs In DUTCH 2 Vol.
(Lab-Rept-764-Pt-1) Avail: NTIS HC A07/MF A01

An approximate scaling calculation for horizontal pressure vessels on ring supports was performed. Three calculation methods (the complete linear scaling theory, the membrane theory and Zick's method) were applied to a reference geometry and vessel loading situation. The effect of the variation of a single parameter with respect to the reference situation is discussed. Stresses and displacements of the cylinder are calculated with a computer program, starting from the Simmonds differential equations and applying the linear scaling theory. The calculations are characterized by slow and fast damping solutions. The complete linear scaling theory is not usable for an arbitrary vessel geometry. The membrane theory allows an estimation of slowly damping solutions. Zick's method does not allow the calculation of a number of important stresses. Author (ESA)

N86-16682# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
AN APPROXIMATE CALCULATION OF HORIZONTAL CIRCULAR-CYLINDRICAL PRESSURE VESSELS SUPPORTED BY RINGS. PART 2: ANNEXES [HORIZONTALE DRUKVATEN. EEN BENADERINGSBEREKENING VAN HORIZONTALE CIRKELCILINDRISCHE DRUKVATEN OP ONDERSTEUNINGSRINGEN. DEEL 2: AANHANGSELS]
G. D. vanderWeijde Oct. 1983 104 p In DUTCH 2 Vol.
(Lab-Rept-764-Pt-2) Avail: NTIS HC A06/MF A01

Approximate calculation of horizontal pressure vessels on ring supports was performed. Geometry of the vessel, definitions, and symbols are presented. Formulas following the complete linear scaling theory, the membrane theory, and Zick's methods were deduced. Calculation examples are given. Calculation results are tabulated. The computer program for horizontal vessels in Fourier components is presented. Author (ESA)

N86-16683# European Space Agency, Paris (France).
THE EXPERIMENTAL/ANALYTICAL DETERMINATION OF THE REAL NORMAL MODE PARAMETERS OF A STRUCTURE WITH LIMITED ACCESSIBILITY Ph.D. Thesis - Hanover Univ., West Germany
Norbert Niedbal Jun. 1985 148 p refs Transl. into ENGLISH of "Die experimentell-rechnerische Ermittlung der reellen Eigenschwingungsgroessen bei begrenzter Zugaenglichkeit der Struktur" Report DFVLR-FB-83-26 Goettingen, West Germany, 1983 Original report in GERMAN previously announced as ESA-91554 (ESA-TT-839; DFVLR-FB-83-26) Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne DM 42

Phase separation methods for the experimental determination of normal mode parameters are proposed. As opposed to the classical phase resonance method, these methods require no adjustment of the exciter forces. In the case of a structure with limited accessibility, such methods improve the experimental modal analysis. A phase separation method is selected and its reliability enhanced for the case of damping coupling. A method to transform complex normal mode parameters into real normal ones is presented. Author (ESA)

N86-16684# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
SYSTEMS SAFETY APPLIED TO DESIGN: THE STUDY OF WALLS [LA SECURITE DES SYSTEMES APPLIQUEE EN CONCEPTION: L'ETUDE D'UNE PAROI]
P. Sarrat (ITBTP, Saint Remy les Chevreuse, France) and M. NKaoua 1985 20 p In FRENCH Presented at 3rd Seminaire Europeen sur la Securite des Systemes, Cannes, France, 19-21 Sep. 1984
(SNIAS-852-422-105) Avail: NTIS HC A02/MF A01

Condensation on the inner surface of a wall composed of two structures with isolation material in between was studied. A preliminary analysis shows all possible causes of moisture accumulation on the internal face of the wall. A tree analysis follows. A quantitative treatment gives a reliability evaluation. The moisture formation probability is given for each case. Author (ESA)

42 GEOSCIENCES (GENERAL)

N86-16685# National Oceanic and Atmospheric Administration, Boulder, Colo.
MARGINAL ICE ZONE BIBLIOGRAPHY
Jun. 1985 199 p
(PB85-242493; GD-17) Avail: NTIS HC A09/MF A01 CSCL 08L

A major bibliography on sea ice, meteorology and oceanography in the marginal ice zone is provided. It has been recognized in the last few years that processes of air-ice-ocean interaction occurring near the boundary of ice-covered seas are of critical importance to our understanding of the mechanisms of seasonal ice growth and decay and short and long term anomalies in ice extent. Oil and gas exploration and development are increasingly being conducted in areas with seasonal ice cover and the ice margin is also a zone of high productivity by marine biota. Until recently, opportunities to conduct research in the marginal ice zone (MIZ) were limited by available technology, but a major international marginal ice zone experiment (MIZEX) is underway in the Bering Sea and the East Greenland Sea and results from this work are now beginning to appear in the literature. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-16686 Washington Univ., Seattle.
THE PETROLOGY AND LOW-TEMPERATURE GEOCHEMISTRY OF THE SULFIDE-BEARING MAFIC-ULTRAMAFIC UNITS OF THE ACOJE MASSIF, ZAMBALES OPHIOLITE, PHILIPPINES: CHARACTERIZATION OF MINERAL AND FLUID EQUILIBRIA Ph.D. Thesis
Teofilo Aniag Abrajano, Jr. 1984 490 p
Avail: Univ. Microfilms Order No. DA8509031

The petrology and low-temperature geochemistry of the sulfide, native metal, and alloy-bearing lenses and layers near the base of this cumulate sequence (BCS) as they are exposed in the surface and subsurface workings was examined. The attainment of highly reducing conditions during hydration of ultramafic rocks, as exemplified in the BCS, is favored by: (1) stable or metastable involvement of olivine in the buffering reactions; (2) high Fe:Mg ratios in olivine and/or pyroxene; and (3) low silica activity during hydration. The textural occurrence and sulfur isotopic signature of the sulfides, and the bulk composition and mineralogy of the least altered sulfides support an initial magmatic origin, by liquid immiscibility, of the BCS sulfides. Dissert. Abstr.

N86-16687* National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES (ISSUE 47)
Oct. 1985 146 p
(NASA-SP-7041(47); NAS 1.21:7041(47)) Avail: NTIS HC $12.50 CSCL 05B

This bibliography lists 524 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1 and September 30, 1985. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economical analysis. Author

N86-16688*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
DEVELOPMENT OF COMPUTER SOFTWARE TO ANALYZE ENTIRE LANDSAT SCENES AND TO SUMMARIZE CLASSIFICATION RESULTS OF VARIABLE-SIZE POLYGONS Final Report
Brian J. Turner, Principal Investigator, George M. Baumer, Wayne L. Myers, and Steven G. Sykes May 1981 29 p refs Original contains imagery. Original photographs may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-26166)
(E86-10020; NASA-CR-177826; NAS 1.26:177826; PSU-IRLWR-RP-106/OR) Avail: NTIS HC A03/MF A01 CSCL 08B

The Forest Pest Management Division (FPMD) of the Pennsylvania Bureau of Forestry has the responsibility for conducting annual surveys of the State's forest lands to accurately detect, map, and appraise forest insect infestations. A standardized, timely, and cost-effective method of accurately surveying forests and their condition should enhance the probability of suppressing infestations. The repetitive and synoptic coverage provided by LANDSAT (formerly ERTS) makes such satellite-derived data potentially attractive as a survey medium for monitoring forest insect damage over large areas. Forest Pest Management Division personnel have expressed keen interest in LANDSAT data and have informally cooperated with NASA/Goddard Space Flight Center (GSFC) since 1976 in the development of techniques to facilitate their use. The results of this work indicate that it may be feasible to use LANDSAT digital data to conduct annual surveys of insect defoliation of hardwood forests. Author

N86-16689*# Maryland Univ., College Park. Remote Sensing Systems Lab.
[ACTIVITIES OF THE PILOT LAND DATA SYSTEM PROJECT] Interim Progress Report
Jayanta K. Sircar, Principal Investigator 15 Nov. 1985 5 p ERTS
(Grant NAG5-512)
(E86-10023; NASA-CR-176377; NAS 1.26:176377) Avail: NTIS HC A02/MF A01 CSCL 05B

The University of Maryland's Remote Sensing Systems Laboratory submitted to NASA/Goddard an interim progress report on the work being conducted within its Pilot Land Data System IPLDS project. The Remote Sensing Systems Laboratory addressed the following tasks: (1) identify data types and data sources needed to describe the selected test sites in collaboration with Goddard's Hydrological Sciences Branch; (2) define the procedures necessary to access/acquire this data; (3) conduct meetings with the PLDS Systems Engineering Group to identify functional specification priorities for PLDS development; (4) assemble documentation on historical remotely sensed imagery and transfer of such information to the PLDS Data Management Group; (5) collect data identified by Goodard's Hydrological Sciences Branch for data set inventory in PLD; (6) develop a Workstation-PLDS system interface over high speed lines, (7) develop and test through a Phase 1 demonstration of a micro workstation to access PLDS; and (8) establish interdepartmental agreement of development of computer link for electronic access of water resources data from USGS. Author

N86-16690*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF SPECTRAL/RADIOMETRIC CHARACTERISTICS OF THE THEMATIC MAPPER FOR LAND USE APPLICATIONS Final Report, 21 Sep. 1982 - 20 Jun. 1985
William A. Malila, Principal Investigator and Michael D. Metzler, Principal Investigator Sep. 1985 54 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-27346)
(E86-10025; NASA-CR-176269; NAS 1.26:176269; ERIM-164000-19-F) Avail: NTIS HC A04/MF A01 CSCL 08B

An investigation conducted in support of the LANDSAT 4/5 Image Data Quality Analysis (LIDQA) Program is discussed. Results of engineering analyses of radiometric, spatial, spectral, and geometric properties of the Thematic Mapper systems are summarized; major emphasis is placed on the radiometric analysis. Details of the analyses are presented in appendices, which contain three of the eight technical papers produced during this investigation; these three, together, describe the major activities and results of the investigation. For individual titles, see N86-16691 through N86-16694.

N86-16691*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF SPECTRAL/RADIOMETRIC CHARACTERISTICS OF THE THEMATIC MAPPER FOR LAND USE APPLICATIONS: OBJECTIVES, ACCOMPLISHMENTS, CONCLUSIONS, AND RECOMMENDATIONS Final Report
William A. Malila and Michael D. Metzler *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications Sep. 1985 p 1-4 refs ERTS (For primary document see N86-16690 07-43)
Avail: NTIS HC A04/MF A01 CSCL 05B

The objectives of this investigation are to quantify the performance of the Thematic Mapper, as manifested by the quality of its image data, in order to suggest improvements in data production and to assess the effects of the data quality on its utility for land resources applications. Analyses of radiometric, spatial, spectral, and geometric effects, with primary emphasis on radiometric effects

are included. This effort is part of the LANDSAT 4/5 Image Data Quality Analysis (LIDQA) program sponsored by the NASA Goddard Space Flight Center. Author

N86-16692*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
CHARACTERIZATION OF LANDSAT-4 MSS AND TM DIGITAL IMAGE DATA
William A. Malila, Michael D. Metzler, Daniel P. Rice, and Eric P. Crist *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications Sep. 1985 p 5-20 refs Repr. from IEEE Transactions on Geoscience and Remote Sensing, v. GE-22, no. 3, May 1984 p 177-191 Previously announced in IAA as A84-33526 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N86-16690 07-43)
(Contract NAS5-27254)
Avail: NTIS HC A04/MF A01 CSCL 05B

The launch of LANDSAT-4 in July 1982 represents a continuation in the remote sensing of earth resources. The 80-m spatial resolution provided by the Multispectral Scanner (MSS) on board the satellite is fine enough to resolve many natural features and land-use details in both rural and urban settings. The second sensor of the spacecraft, the Thematic Mapper (TM), introduce a new era of sensing with refined spatial resolution (30 m) and expanded spectral coverage (7 bands). This paper describes results from engineering studies of the characteristics of digital image data from the two LANDSAT-4 sensors are described. These studies form a part of the LANDSAT-4 Image Data Quality Analysis program (LIDQA). The image data were generally found to be of high quality and the TM provided several improvements over the MSS, in its spatial and spectral characteristics. Author

N86-16693*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
CHARACTERIZATION AND COMPARISON OF LANDSAT-4 AND LANDSAT-5 THEMATIC MAPPER DATA
William A. Malila and Michael D. Metzler *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications Sep. 1985 p 21-37 refs Repr. from Photogrammetric Engineering and Remote Sensing, v. 51, no. 9, Sep. 1985 p 1315-1330 Previously announced in IAA as A85-47809 ERTS (For primary document see N86-16690 07-43)
Avail: NTIS HC A04/MF A01 CSCL 08B

Engineering analyses of Thematic Mapper (TM) image data have been conducted, giving particular attention to the radiometric characterization of the sensor. While the data in general were found to be excellent, anomalies do exist in the data from both LANDSAT-4 and LANDSAT-5 TM. A summary is provided of the LANDSAT-5 TM image data. Recent analyses of LANDSAT-5 TM data and comparisons of the radiometry of the two sensors are emphasized. One of the specific topics covered is within-line droop, a phenomenon whereby the signal levels of the sensor change systematically during the active scan. Attention is also given to scan-correlated level shifts, an effect which raises or lowers the signal level of all pixels in a scan line or set of scan lines. A comparison of LANDSAT-4 and LANDSAT-5 radiometric corrections is also discussed. Author

N86-16694*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
COMPARISON OF THE INFORMATION CONTENTS OF LANDSAT TM AND MSS DATA
William A. Malila *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications Sep. 1985 p 39-48 refs Repr. from Photogrammetric Engineering and Remote Sensing, v. 51, no. 9, Sep. 1985 p 1449-1457 Previously announced in IAA as A85-47822 ERTS (For primary document see N86-16690 07-43)
Avail: NTIS HC A04/MF A01 CSCL 08B

A communications-theory approach is taken to analyze the dispersion and concentration of signal values in various data spaces, irrespective of specific class membership. Entropy is used to quantify information, and mutual information is used to measure the information represented by subsets of spectral variables. Several different comparisons of information content are made. These include comparisons of system design capacities, of data volumes occupied by agricultural data in the spaces defined by original bands and by transformed spectral (Tasseled Cap) variables, of the information contents of original bands and Tasseled Cap variables, and of the information contents of TM and MSS for the given agricultural data sets. Also, the effects of sample size, scene content, and quantization level are examined. Author

N86-16695# Geological Survey, Washington, D.C.
ESTIMATED USE OF WATER IN THE US IN 1980
Wayne B. Solley, Edith B. Chase, and William B. Mann, IV 1985 65 p refs
(GS-Circ-1001) Avail: NTIS HC A04/MF A01

Water use in the United States in 1980 was estimated to be an average of 450 bgd (billion gallons per day) of fresh and saline water for offstream uses - an 8% increase from the 1975 estimate and a 22% increase from the 1970 estimate. Average per capita use for all offstream uses was 2,000 gpd (gallon per day) of fresh and saline water, and 1,600 gpd of fresh water; this represents a slight increase since 1975. Although 1980 estimates of water use were higher than the 1975 estimates for all offstream categories, trends established during the periods 1970 to 1975 and 1975 to 1980 indicate a general slackening in the rate of increase of total withdrawals in comparison to the period 1965 to 1970. E.A.K.

N86-16696# Committee on Science and Technology (U. S. House).
LANDSAT COMMERCIALIZATION
Washington GPO 1985 84 p Hearing before the Comm. on Sci. and Technol., 99th Congr., 1st Sess., No. 30, 13 Jun. 1985 (GPO-49-336) Avail: Subcommittee on Natural Resources, Agriculture Research and Environment and Subcommittee on Space Science and Applications

Hearings were held in the U.S. House of Representatives by the Subcommittee on Natural Resources, Agriculture Research and Environment, and the Subcommittee on Space Science and application on the commercialization of the LANDSAT Program. The goal was to establish a commercial U.S. civil operation land-observing satellite program. E.A.K.

N86-16697*# Oklahoma Univ., Norman. Cooperative Inst. for Mesoscale Meteorological Studies.
DEVELOPMENT OF THE VARIATIONAL SEASAT DATA ANALYSIS TECHNIQUE Final Report
Yoshi K. Sasaki, Lang-Ping Chang, and James S. Goerss Dec. 1985 80 p refs
(Grant NAG5-289)
(NASA-CR-176471; NAS 1.26:176471) Avail: NTIS HC A05/MF A01 CSCL 05B

Surface winds are closely associated with the surface pressure gradient. The variational SEASAT data analysis technique was designed to improve the sea level pressure analysis in the data sparse areas. The SEASAT-derived surface wind data were compared with observations from the Joint Air Sea Interaction Experiment (JASIN) and it was found that the satellite-derived sea surface wind has an accuracy of up to + or - 2 m/s in speed and + or - 20 deg in direction. These numbers are considered characteristic of the retrieved SEASAT wind field. By combining the densely spaced SEASAT-derived wind data with the sparsely distributed sea-level pressure observation via a variational adjustment technique subject to some appropriate physical constraint(s), an improvement in the sea-level pressure analysis is expected. It is demonstrated that a simple marine boundary layer scheme in conjunction with a variational adjustment technique can be developed to help improve the sea-level pressure analysis by the SEASAT-derived wind of a limited-area domain in the ocean. E.A.K.

N86-16698# California Univ., Davis. Signal and Image Processing Lab.
A TUTORIAL ON CREATING A GRID CELL LAND COVER DATA FILE FROM REMOTE SENSING DATA Final Report
G. E. Ford, D. I. Meyer, and V. R. Algazi Jun. 1985 78 p
(Contract DACW05-83-C-0112)
(AD-A159365; SIPL-85-4; SIPL-TD-22) Avail: NTIS HC A05/MF A01 CSCL 09/2

This document describes the procedures involved in linking a remote sensing system and a spatial data management system. Specifically, it identifies and describes a sequence of steps for the classification of LANDSAT multispectral scanner (MSS) data and the creation of a grid cell land cover data file. The resulting grid cell file can be merged into a Hydrologic Engineering Center (HEC) Spatial Analysis Methodology (SAM) spatial database. The procedures are also applicable to remote sensing data acquired from other sensor systems. The presentation is intended for those who are familiar with the SAM system and the characteristics and potential of remote sensor image data. Author (GRA)

N86-16699# Defense Mapping Agency, Washington, D.C.
RESULTS OF OPERATIONAL TESTING OF LASS-2 (LITTON AUTO-SURVEYOR SYSTEM) SYSTEMS Final Report, Aug. 1984 - May 1985
L. Pfeifer and R. Tyszka Sep. 1985 14 p
(AD-A159367) Avail: NTIS HC A02/MF A01 CSCL 08/5

The Defense Mapping Agency has been active in the field of inertial surveying since 1975. More recently, delivery was taken of two Litton Auto-Surveyor System 2 (LASS-2) units. This paper describes the testing carried out with these two systems over the Cheyenne IPS Test Course and presents a statistical analysis of the results obtained. New mathematical models for the RMS error of interpolated position and height as a function of traverse length are proposed. The Litton Auto-Surveyor System 2 is an upgraded version of the Position and Azimuth Determining System intended for applications in surveying and geodesy. The hardware features which set a LASS-2 apart from a PADS are: (1) gyros screened to tighter performance specifications; (2) modifications to the control/display unit (CDU); (3) addition of a digital tapedeck and associated interface electronics; and (4) a coat of paint change from olive drab to off-white which, aside from giving the LASS-2 a distinctive look, has the functional purpose of aiding with the management of heat dissipation. GRA

N86-16700# South Carolina Univ., Columbia. Dept. of Geography.
REMOTE SENSING FOREST BIOMASS FOR LOBLOLLY PINE USING HIGH RESOLUTION AIRBORNE SENSOR DATA
J. R. Jensen, M. E. Hodgson, and H. E. Mackey, Jr. 1985 30 p refs Presented at the Forest Land Applications Symposium, Seattle, Wash., 25 Jun. 1985 Prepared in cooperation with Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
(Contract DE-AC09-76SR-00001)
(DE85-017058; DP-MS-85-62; CONF-8506167-2) Avail: NTIS HC A03/MF A01

The amount and spatial distribution of vegetation are important parameters useful in agriculture, forestry, wetland, and hydrologic research. Such data may be collected in situ by harvesting a sample of the vegetation and determining the amount of biological matter. This approach provides single point estimates which are expensive to collect and difficult to extend through space in order to map the geographic distribution of biomass. It is, however, possible in certain instances to obtain acceptable estimates of biomass by analyzing remotely sensed data. This paper describes the analysis of very high resolution, remotely sensed data of loblolly pine (Pinus taeda) in a controlled experiment in South Carolina. Loblolly pine was examined because it represents over 70% of the commercial forest in the southeastern United States. Pine plots located on both sandy and clay soils were treated with sewage sludge to provide 0, 445, or 890 kg of nitrogen per hectare. Indices of biomass from remote sensing data were significantly correlated with in situ biomass measurements made in each plot. A ratio of infrared (0.9 to 1.1. micron m) and red (0.65 to 0.70 micron m) channels yielded the best correlation between the remote sensing data and the in situ biomass measurements. In addition, remote sensing provided a quantitative map of the spatial distribution of the biomass in the forest plots. The indices of biomass from the remote sensing data were not sensitive to differences in soil type (sandy or clay). DOE

N86-16701# South Carolina Univ., Columbia. Dept. of Geography.
REMOTE SENSING INLAND WETLANDS: A MULTISPECTRAL APPROACH
J. R. Jensen, M. E. Hodgson, E. Christensen, H. E. Mackey, Jr., L. R. Tinney, and R. Sharitz 1985 36 p refs Prepared in cooperation with Du Pont de Nemours (E.I.) and Co., Aiken, S.C. and Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
(Contract DE-AC09-76SR-00001)
(DE85-017060; DP-MS-85-68) Avail: NTIS HC A03/MF A01

Airborne Multispectral Scanner (MSS) data, large-scale aerial photography, and LANDSAT MSS and Thematic Mapper (TM) data is used to map a variety of wetland conditions along the Savannah River watershed in South Carolina. Predawn thermal infrared MSS imagery is analyzed to map the spatial distribution and migration of thermal effluent entering a portion of the Savannah River floodplain and the Savannah River below Augusta, Georgia. Daytime airborne MSS data are used to classify specific wetland vegetation types and associate them with their apparent (remotely sensed) temperature. Large scale, multiple data aerial photography are ideally suited to follow the growth of vegetational changes associated with the thermal discharges into the floodplain. LANDSAT MSS imagery obtained in the spring is used effectively to map the entire Savannah River watershed. LANDSAT TM imagery obtained in the summer is of limited use in regional wetland mapping. DOE

N86-16702# New Mexico State Univ., Las Cruces. Energy Inst.
AN EVALUATION OF THERMAL REMOTE SENSING AS A LOW-COST REGIONAL GEOTHERMAL EXPLORATION TECHNIQUE IN NEW MEXICO Final Report
Jack Whittier, Michael Inglis (New Mexico Univ., Albuquerque), and Thomas K. Budge (New Mexico Univ., Albuquerque) Mar. 1985 53 p
(DE85-901266; NMERDI-2-71-4221) Avail: NTIS HC A04/MF A01

Airborne and satellite borne thermal infrared scanner data were analyzed for application in the exploration of geothermal resources in New Mexico. The location for this study was the East Mesa Geothermal Field near Las Cruces, New Mexico. Primary sensor was the Thermal Infrared Multispectral Scanner (TIMS) which obtained data at 10-meter resolution. Additional data for comparison came from the Heat Capacity Mapping Mission (HCMM) satellite which provided data at 600-meter resolution. These data were compared to the soils, vegetation, and geology of the area, as well as borehole temperature data in an attempt to explain temperature patterns and anomalies. Thermal infrared scanner data were found to be too sensitive to solar-induced temperature anomalies to directly reflect the presence of subsurface geothermal anomalies but may provide valuable supporting information for a geothermal exploration program. DOE

N86-16703# Geological Survey, Tacoma, Wash.
COLUMBIA GLACIER IN 1984: DISINTEGRATION UNDERWAY
M. F. Meier, L. A. Rasmussen, and D. S. Miller 1985 20 p
(TI86-900055; USGS-OFR-85-81) Avail: NTIS HC A02/MF A01

The Columbia Glacier is a large, iceberg-calving glacier near Valdez, Alaska. During this period the glacier terminated partly on Heather Island and partly on a submerged moraine shoal. It was suggested that if the glacier were to retreat from the stabilizing moraine shoal, a period of drastic retreat would ensue. The glacier terminus retreated from Heather Island, and retreat has accelerated each year, except during a period of anomalously low calving. Although the glacier has not terminated on Heather Island since 1978, a portion of the terminus remained on the crest of the moraine shoal until the fall of 1983. The feature receded more

than 300 m from the crest of the shoal, laters disappeared completely, leaving most of the terminus more than 2,000 meters behind the crest of the shoal. Recession of the glacier from the shoal has placed the terminus in deeper water, although the glacier does not float. The active calving face of the glacier now terminates in seawater that is about 300 meters deep at the glacier centerline. Rapid calving appears to be associated with buoyancy effects due to deep water at the terminus and subglacial runoff. DOE

N86-16704# Pacific Northwest Lab., Richland, Wash.
OPPORTUNITIES AND DIFFICULTIES ASSOCIATED WITH USING LANDSAT THEMATIC MAPPER DATA FOR DETERMINING SURFACE WATER TEMPERATURES
G. W. Wukelic, J. C. Barnard, G. M. Petrie, and H. P. Foote Jun. 1985 14 p refs Presented at the NASA LIDQU Final Symposium: LANDSAT Image Data Quality Analysis Meeting, Indianapolis, Ind., 9 Sep. 1985
(Contract DE-AC06-76RL-01830)
(DE85-017925; PNL-SA-13259; CONF-8509161-1) Avail: NTIS HC A02/MF A01

This paper describes results of research efforts to estimate surface-water temperatures using LANDSAT 4 and 5 TM thermal band data. Recent research involved the analysis of day- and night-time TM Band 6 data in both corrected (P tape) and uncorrected (A tape) formats. Results reported are for: (1) a reservoir reactor cooling system (PAR Pond) at the Department of Energy's (DOE) Savannah River Plant in Aiken, South Carolina, and (2) the Columbia River adjacent to the DOE's Hanford site in southeastern Washington State. Differences between LANDSAT-derived surface water temperatures and ground truth values before and after correcting for atmospheric effects (using LOWTRAN) are described. The results substantiate the consistent performance of the LANDSAT TM thermal sensor for providing potentially useful estimates of relative and absolute temperatures for large water bodies within and between TM scenes. In addition, technical difficulties encountered that currently limit routine use of such data for environmental monitoring, such as calibration, mixed pixel phenomena, and atmospheric effects are addressed. DOE

N86-16705# Battelle Memorial Inst., Argonne, Ill. Office of Crystalline Repository Development.
NORTH CENTRAL REGIONAL GEOLOGIC CHARACTERIZATION REPORT. VOLUME 1 Final Report
Aug. 1985 563 p
(Contract DE-AC02-83CH-10139)
(DE86-000414; DOE/CH-8(1)-FINAL) Avail: NTIS HC A24/MF A01

This report presents available geologic information pertinent to siting a repository for high-level nuclear waste in crystalline rock in Minnesota, Wisconsin, and the Upper Peninsula of Michigan. For each of the states within the North Central Region, information is provided on the geologic disqualifying factor and the geologic regional screening variables to be used in region-to-area screening. The geologic factor and variables include deep mines and quarries, rock mass extent, post-emplacement faulting, suspected Quaternary faulting, seismicity, rock and mineral resources, major groundwater discharge zones, groundwater resources, state of stress, thickness of rock mass, and thickness of overburden. Information is presented on age, areal extent, shape, composition, texture, degree and type of alteration, thickness, and structural features associated with each rock body or complex. Regional seismic and tectonic information is presented, including patterns of earthquake occurrence, earthquake magnitudes, horizontal ground accelerations, and vertical crustal movements. Also included are discussions of the rock and mineral deposits or mines located within or near crystalline rock bodies; groundwater resources and regional hydrology; postulated changes in climate and the associated effects; and landforms, surface processes, and surficial materials on or near the rock bodies. A discussion is also presented of the relationship between the US Department of Energy Siting Guidelines (10 CFR 960) and the geologic disqualifying factor and regional screening variables to be used in the region-to-area screening process. DOE

N86-16706# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
NATIONAL REPORT OF THE NETHERLANDS, 1980 - 1984
G. H. Ligterink 1984 25 p refs Presented at 15th International Society of Photogrammetry and Remote Sensing International Congress, Rio de Janeiro, Brazil, 1984
Avail: NTIS HC A02/MF A01

Developments in photogrammetry, remote sensing, and image interpretation are outlined. Photogrammetric instruments, triangulation, and mapping are described. Educational activities are summarized. Author (ESA)

N86-16707# Geological Survey, Sacramento, Calif. Water Resources Div.
WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1983. VOLUME 4: NORTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE Annual Report, 1 Oct. 1982 - 30 Sep. 1983
R. P. Fogelman, J. R. Mullen, W. F. Shelton, R. G. Simpson, and D. A. Grillo Mar. 1985 376 p Prepared in cooperation with California State Dept. of Water Resources, Sacramento, Calif.
(PB85-232320; USGS/WDR/CA-83/4-Vol-4;
USGS/WRD/HD-85/219-Vol-4) Avail: NTIS HC A17/MF A01 CSCL 08H

Water-resources data for the 1983 water year for California consists of: (1) records of stage, discharge, and water quality of streams; (2) stage and contents in lakes and reservoirs; and (3) water levels and water quality in wells. Discharge records for 153 gaging stations; stage and contents for 25 lakes and reservoirs; precipitation data for 2 stations; water quality for 7 stations; and water levels for 147 observation wells are presented. Also included is one low-flow partial-record station. GRA

N86-16708# Geological Survey, Nashville, Tenn. Water Resources Div.
WATER RESOURCES DATA FOR TENNESSEE, WATER YEAR 1984 Annual Report, 1 Oct. 1983 - 30 Sep. 1984
J. F. Lowery, P. H. Counts, H. L. Edmiston, and F. D. Edwards Mar. 1985 343 p Prepared in cooperation with Tennessee Dept. of Health and Environment, Nashville and Tennessee Valley Authority, Knoxville
(PB85-232338; USGS/WDR/TN-84/1; USGS/WRD/HD-85/216)
Avail: NTIS HC A15/MF A01 CSCL 08H

Water resources data for the 1984 water year for Tennessee consist of records of stage, discharge, and water quality of streams and springs; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells. The report contains discharge records for 91 gaging stations; stage only records for 2 lake gaging stations; elevation and contents for 28 lakes and reservoirs; water quality for 22 stations; and water levels for 32 observation wells. Also included are 93 crest-stage partial-record stations and 79 low-flow partial-record stations.
Author (GRA)

N86-16709# Geological Survey, Columbus, Ohio. Water Resources Div.
WATER RESOURCES DATA FOR OHIO, WATER YEAR 1984. VOLUME 1: OHIO RIVER BASIN Annual Report, 1 Oct. 1983 - 30 Sep. 1984
H. L. Shindel, L. L. Stewart, and J. R. Kolva Apr. 1985 330 p
(PB85-233500; USGS/WRD/OH-84/1-Vol-1;
USGS/WRD/HD-85/222-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 08H

Water resources data for the 1984 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of groundwater wells. Records for water discharge at 127 gaging stations, stage and contents at 4 lakes and reservoirs; water quality at 31 gaging stations, 32 wells, and 14 partial record sites; and water levels at 387 observation wells are given. Also included are data from 60 crest-stage partial-record stations and 4 miscellaneous sites. GRA

N86-16710# Geological Survey, Helena, Mont. Water Resources Div.
WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1984. VOLUME 2: COLUMBIA RIVER BASIN Annual Water-Data Report, 1 Oct. 1983 - 30 Sep. 1984
R. R. Shields, J. R. Knapton, M. K. White, M. A. Jacobson, and M. L. Kasman Apr. 1985 28 p
(PB85-235984; USGS/WRD/HD-85/227-Vol-2; USGS/WDR/MT-84/2-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 08H

Water resources data for the 1984 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. Discharge records for 56 gaging stations; stage/contents for 3 lakes and reservoirs; water quality for 20 stations, 3 lakes; and water levels for 10 observation wells are given. Also included are 31 crest-stage partial-record stations and 20 smaller reservoirs. GRA

N86-16711# Geological Survey, Tacoma, Wash. Water Resources Div.
WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1982. VOLUME 1: WESTERN WASHINGTON Annual Water-Data Report, 1 Oct. 981 - 30 Sep. 1982
Mar. 1985 325 p
(PB85-236826; USGS/WRD/HD-85/220-Vol-1; USGS/WDR/WA-82/1-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 08H

Water resources data for the 1982 water year for Washington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells and springs. Discharge records for 253 gaging stations; stage only records for 8 gaging stations; stage and contents for 37 lakes and reservoirs; water quality for 81 gaging stations; and water levels for 57 observation wells are given. Data for 33 crest-stage partial-record stations are included. GRA

N86-16712# Geological Survey, Menlo Park, Calif.
PRINCIPAL FACTS, ACCURACIES AND SOURCES FOR 1,951 GRAVITY STATIONS ON THE WINNEMUCCA 1 DEG BY 2 DEG QUADRANGLE, NEVADA
A. Wagini 1985 79 p
(PB85-235927; USGS/GD-85/005) Avail: NTIS HC A05/MF A01 CSCL 08E

Principal factors for 1,951 gravity stations on the Winnemucca 1 deg by 2 deg quadrangle, Nev., are described. The data are presented in tables according to source and include station name, latitude and longitude, elevation, observed gravity, accuracy code, free-air anomaly, simple Bouguer gravity anomaly, inner zone and total terrain corrections, complete Bouguer gravity anomaly, and residual isostatic gravity value. The principal facts are accompanied by base station descriptions and station location plots.
Author (GRA)

N86-16713# Minnesota Univ., St. Paul. Water Resources Research Center.
FISCAL YEAR 1983 PROGRAM REPORT, WATER RESOURCES RESEARCH CENTER, UNIVERSITY OF MINNESOTA, REVISED
G. R. Blake 2 Apr. 1985 29 p
(Grant DI-14-08-0001-G-850)
(PB85-232924; USGS/G-850-01) Avail: NTIS HC A03/MF A01 CSCL 08H

The Fiscal Year 1983 Program Report of the University of Minnesota Water Resources Center presents a summary of activities for fiscal year 1983. It covers the period October 1, 1982 through September 30, 1984. The report describes the research activities of the Center, its involvement in training water scientists and its effort in transferring technologic information to potential users. Research progress reports of six sponsored projects are included in the report. Author (GRA)

N86-16714# Geological Survey, Bismarck, N. Dak. Water Resources Div.
WATER RESOURCES DATA FOR NORTH DAKOTA, WATER YEAR 1983 Annual Water-Data Report, 1 Oct. 1982 - 30 Sep. 1983
Dec. 1984 395 p
(PB85-236305; USGS/WRD/HD-85/209; USGS/WDR/ND-83/1) Avail: NTIS HC A17/MF A01 CSCL 08H

Water resources data for the 1983 water year for North Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. The report contains discharge records for 112 gaging stations; stage only records for 17 gaging stations; stage and contents for 10 lakes and reservoirs; water quality for 109 gaging stations; 5 lakes, 29 wells, and water levels for 31 observation wells. Author (GRA)

N86-16715# Geological Survey, Carson City, Nev. Water Resources Div.
WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1984 Annual Water-Data Report, 1 Oct. 1983 - 30 Sep. 1984
H. R. Frisbie, R. J. LaCamera, M. M. Riek, and D. B. Wood Aug. 1958 256 p
(PB85-236313; USGS/WRD/HD-85/233; USGS/WDR/NV-84/1) Avail: NTIS HC A12/MF A01 CSCL 08H

Water-resources data published herein for the 1984 water year comprise the following records: Water discharge for 89 gaging stations on streams, canals, and drains; discharge data for 40 peak-flow stations and 3 low-flow stations on streams; stage and contents for 15 lakes and reservoirs; water levels for 312 observation wells; water-quality data for 67 stream, canal, and drain sites, 3 lakes and reservoir sites, and 3 wells.
Author (GRA)

N86-16716# Bureau of Mines, Washington, D. C.
MINERALS YEARBOOK, 1983. VOLUME 2: AREA REPORTS, DOMESTIC
1985 607 p
(PB85-238822; BM-MYB-1983-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 08I

The volume of the 1983 Minerals Yearbook contains chapters on the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, and the Commonwealth of Puerto Rico. This volume also has a statistical summary. GRA

N86-16717# Geological Survey, Carson City, Nev. Water Resources Div.
WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1983 Annual Water-Data Report, 1 Oct. 1982 - 30 Sep. 1983
H. R. Frisbie, R. J. LaCamera, M. M. Riek, and D. B. Wood Dec. 1984 338 p
(PB85-210953; USGS/WRD/HD-85/206; USGS/WDR/NV-83/1) Avail: NTIS HC A15/MF A01 CSCL 08H

Water-resources data published herein for the 1983 water year comprise the following records for Nevada: water discharge for 109 gaging stations on streams, canals, and drains; discharge data for 35 peak-flow stations and 5 low-flow stations on streams; stage and contents for 21 lakes and reservoirs; water levels for 316 observation wells; water-quality data for 85 stream, canal, and drain sites, 12 lakes and reservoir sites, and 3 wells.
Author (GRA)

N86-16718# Geological Survey, Lakewood, Colo.
WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1983. VOLUME 3: DOLORES RIVER BASIN, GREEN RIVER BASIN AND SAN JUAN RIVER BASIN Annual Water-Data Report, 1 Oct. 1982 - 30 Sep. 1983
J. T. Steinheimer, R. C. Ugland, H. E. Burch, and E. A. Wilson Jul. 1984 283 p
(PB85-210946; USGS/WRD/HD-84/37-Vol-3; USGS/WDR/CO-83/3-Vol-3) Avail: NTIS HC A13/MF A01 CSCL 08H

Water-resources data for Colorado for the 1983 water year consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of wells and springs. The report contains discharge records for 400 gaging stations, stage and contents of 23 lakes and reservoirs, 6 partial-record low-flow stations, peak flow information for 19 crest-stage partial record stations, and 20 miscellaneous sites; water quality for 132 gaging stations and 291 miscellaneous sites; and water levels for 55 observation wells. Author (GRA)

N86-16719# Geological Survey, Boston, Mass. Water Resources Div.

WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1983 Annual Water-Data Report, 1 Oct. 1982 - 30 Sep. 1983

F. E. Blackey, J. E. Cotton, and K. W. Toppin Dec. 1984 155 p (PB85-210938; USGS/WRD/HD-85/210; USGS/WDR/NH/VT-83/1) Avail: NTIS HC A08/MF A01 CSCL 08H

Water-resources data for the 1983 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; stage and content of lakes and reservoirs; and ground-water levels. This report contains discharge records for 78 gaging stations, stage records for 4 lakes, month end contents for 25 lakes and reservoirs, water-quality data for 3 gaging stations, and water levels for 30 observation wells. Also included are data for 4 crest stage partial-record stations. Author (GRA)

N86-16720# Geological Survey, Harrisburg, Pa. Water Resources Div.

WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1983. VOLUME 1: DELAWARE RIVER BASIN Annual Water-Data Report, 1 Oct. 1982 - 30 Sep. 1983

T. E. White, K. P. Gillespie, D. W. Speight, and R. L. Druther Oct. 1984 273 p Prepared in cooperation with Pennsylvania Dept. of Environmental Resources, Harrisburg and Philadelphia Water Dept., Pa. (PB85-210920; USGS/WRD/HD-85/207-Vol-1; USGS/WDR/PA-83/1-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 08H

Water resources data for the 1983 water year for Pennsylvania consist of records of discharge and water quality of streams; elevation and contents of lakes and reservoirs; and elevation of tides; and water levels of ground-water wells. This volume contains records for water discharge at 68 gaging stations; elevation of tides at 5 gaging stations; water quality at 33 gaging stations; and water levels at 16 observation wells. Also included are data for 33 crest-stage, 62 low-flow, and 43 water-quality partial-record stations. Author (GRA)

N86-16721# Geological Survey, Columbia, S.C. Water Resources Div.

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1983 Annual Water-Data Report, 1 Oct. 1982 - 30 Sep. 1983

C. S. Bennett, R. D. Hayes, J. W. Gissendanner, and H. E. Herlong Jan. 1985 355 p (PB85-210573; USGS/WRD/HD-85/208; USGS/WDR/SC-83/1) Avail: NTIS HC A16/MF A01 CSCL 08H

Water resources data for the 1983 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 77 gaging stations, stage only at 5 gaging stations, stage and contents at 11 lakes and reservoirs, water quality at 39 gaging stations, and water levels at 67 observation wells. Also included are data for 40 crest-stage partial-record stations. Author (GRA)

N86-16722# Illinois State Geological Survey, Champaign.

SUPPLEMENTAL GROUNDWATER SUPPLIES FOR SIX SMALL COMMUNITIES IN ILLINOIS

V. Poole and R. Vaiden 1985 42 p Sponsored in part by Illinois State Dept. of Transportation (PB85-210029; IL/SGS/EGN-108) Avail: NTIS HC A03/MF A01 CSCL 08H

Many small Illinois communities that depend on groundwater to supply their municipal water systems experienced water shortages during the drought of 1976 to 1977. In this supplemental geophysical assessment of the aquifiers supplying groundwater to these towns, six communities were selected (on the basis of past shortages and projected needs) as sites for exploration programs to locate sites for new municipal wells. Electrical earth resistivity surveys were used extensively to evaluate the water-producing capacities of the glacial deposits and to provide a basis for recommendations for test-drilling locations. Author (GRA)

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-16723*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

HIGH-EFFICIENCY SILICON SOLAR-CELL DESIGN EVALUATION AND SENSITIVITY ANALYSIS

Anant R. Mokashi, Taher Daud, and Ram H. Kachare 15 Oct. 1985 55 p refs (Contracts NAS7-918; DE-AI01-76ET-20356) (NASA-CR-176445; JPL-Pub-85-46; DOE/JPL-1012-107; NAS 1.26:176445) Avail: NTIS HC A04/MF A01 CSCL 10A

A copy of Solar Cell Analysis Program in 1 Dimension (SCAPID) from Purdue University and a copy of Stanford University Process Engineering Model-II (SUPREM II) were obtained and made functional at the Jet Propulsion Laboratory. They are used as basic analytical tools for high-efficiency silicon solar cell design, evaluation, and sensitivity analysis. A brief description of the mathematical model used in the SCAPID program, including heavy doping effects, is presented. Results are compared with experimental data on representative high-efficiency cells. Sensitivity analysis of an 18.7% efficient cell reported in the literature is made with respect to key device parameters. The analysis indicates that a maximum efficiency of 20% is achievable. This efficiency is estimated by using: (1) cell thickness of 280 micrometers, with minority carrier lifetime on the order of 100 microsec; (2) complementary error function doping profile for 0.2 micrometers emitter thickness; (3) front-surface recombination velocity of 1000 cm/s. The back-surface field has a marginal effect in improving efficiency with minority carrier diffusion length less than cell thickness. Author

N86-16724*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SENSITIVITY ANALYSIS OF A PASSIVATED THIN SILICON SOLAR CELL

Anant R. Mokashi, Taher Daud, and Ram H. Kachare 1 Nov. 1985 35 p refs (Contracts NAS7-918; DE-AI01-76ET-20356) (NASA-CR-176446; JPL-Pub-85-48; DOE/JPL-1012-108; NAS 1.26:176446) Avail: NTIS HC A03/MF A01 CSCL 10A

A new high-efficiency silicon solar-cell design is analyzed. Innovative design features are incorporated to reduce losses. Bulk recombination losses are reduced by making the cell thin (100 micrometers). A back-surface reflector compensates for the optical absorption losses due to cell thinness. Both surfaces

(front and back) are considered to be passivated by a silicon dioxide layer to reduce the surface recombination velocities. Recommendation losses under the contacts are reduced by providing a heavily doped polysilicon layer between the metal and the silicon surface. This design is evaluated by using the Solar Cell Analysis Program in One Dimension (SCAPID), developed at Purdue University. Sensitivity analysis is performed with respect to key parameters such as cell thickness, back-surface recombination velocity and minority carrier lifetime. Practically achievable values for the surface recombination velocities at the front (S sub F) and at the back (S sub B) of 1000 cm/s, and the minority carrier lifetime (Tau) of 20 microsecs have been considered. The new cell design is evaluated and shown to be capable of achieving 20% efficiency. Considerable reduction of S sub F and S sub B and substantial improvement in Tau would be necessary to achieve cell efficiency greater than 20%. Author

N86-16725*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STIRLING ENGINE ALTERNATIVES FOR THE TERRESTRIAL SOLAR APPLICATION
J. Stearns Oct. 1985 118 p refs
(Contracts NAS7-918; DE-AM04-80AL-13137)
(NASA-CR-176450; JPL-Pub-85-70; DOE/JPL-1060-91; NAS 1.26:176450) Avail: NTIS HC A06/MF A01 CSCL 10B

The first phase of the present study of Stirling engine alternatives for solar thermal-electric generation has been completed. Development risk levels are considered to be high for all engines evaluated. Free-piston type and Ringbom-type Stirling engine-alternators are not yet developed for the 25 to 50-kW electrical power range, although smaller machines have demonstrated the inherent robustness of the machines. Kinematic-type Stirling engines are presently achieving a 3500 hr lifetime or longer on critical components, and lifetime must still be further extended for the solar application. Operational and technical characteristics of all types of Stirling engines have been reviewed with engine developers. Technical work of merit in progress in each engine development organization should be recognized and supported in an appropriate manner. Author

N86-16726*# TRW, Inc., Redondo Beach, Calif. Engineering and Test Div.
DESIGN, PERFORMANCE INVESTIGATION AND DELIVERY OF A MINIATURIZED CASSEGRAINIAN CONCENTRATOR SOLAR ARRAY Final Technical Report
Robert E. Patterson May 1985 86 p
(Contract NAS8-35635)
(NASA-CR-178571; NAS 1.26:178571; Rept-42977-6002-UT-00) Avail: NTIS HC A05/MF A01 CSCL 10A

A miniaturized Cassegrainian concentrator (MCC) solar array concept is being developed with the objective of significantly reducing the recurring cost of multikilowatt solar arrays. The desired cost reduction is obtained as a result of using very small high efficiency solar cells in conjunction with low-cost optics. In the MCC single element concept and panel concept, incident solar radiation is reflected from a primary parabolic reflector to a secondary hyperbolic reflector and finally to a 4-millimetr diameter solar cell. A light catcher cone is used to improve off-axis performance. An element is approximately 13-millimeters thick which permits efficient launch stowage of the concentrator system panels without complex optical component deployments or retractions. The MCC elements are packed in bays within graphite epoxy frames and are electrically connected into appropriate series-parallel circuits. A MCC single element with a 21 sq cm entrance aperture and a 20 percent efficient, 0.25 sq cm gallium arsenide solar cell has the same power output as 30-sq cm of 11-percent efficiency (at 68 C) silicon solar cells. The MCC concept provides the potential for a significant reduction in array cost due to a 99 percent reduction in required cell area and a 30 percent reduction in array area relative to planar array of equivalent power. Author

N86-16727# Pacific Northwest Lab., Richland, Wash.
PRELIMINARY ANALYSIS OF PATENT TRENDS FOR SODIUM/SULFUR BATTERY TECHNOLOGY
M. B. Triplett, C. Winter, and W. B. Ashton Jul. 1985 78 p
(Contract DE-AC06-76RL-01830)
(DE85-016091; PNL-5422) Avail: NTIS HC A05/MF A01

This document summarizes development trends in sodium/sulfur battery technology based on data from US patents. Purpose of the study was to use the activity, timing and ownership of 285 US patents to identify and describe broad patterns of change in sodium/sulfur battery technology. The analysis was conducted using newly developed statistical and computer graphic techniques for describing technology development trends from patent data. This analysis suggests that for some technologies trends in patent data provide useful information for public and private R and D planning. DOE

N86-16728# Pona (J.), Hillside, N.J.
INCREASING THERMAL EFFICIENCY OF SOLAR FLAT PLATE COLLECTORS
J. Pona [1985] 36 p
(Contract DE-FG42-81R2-05275)
(DE85-015636; DOE/R2-05375/T1) Avail: NTIS HC A03/MF A01

A study of methods to increase the efficiency of heat transfer in flat plate solar collectors is presented. In order to increase the heat transfer from the absorber plate to the working fluid inside the tubes, turbulent flow was induced by installing baffles within the tubes. The installation of the baffles resulted in a 7 to 12% increase in collector efficiency. Experiments were run on both 1 sq ft and 2 sq ft collectors each fitted with either slotted baffles or tubular baffles. A computer program was run comparing the baffled collector to the standard collector. The results obtained from the computer show that the baffled collectors have a 2.7% increase in life cycle cost (LCC) savings and a 3.6% increase in net cash flow for use in domestic hot water systems, and even greater increases when used in solar heating systems. DOE

N86-16729# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.
STUDIES OF CHEMICAL VAPOR DEPOSITION OF AMORPHOUS SILICON AND TRANSPARENT ELECTRODES FOR SOLAR CELLS Final Report, 1 Apr. 1983 - 30 Sept. 1984
R. G. Gordon, S. Kurtz, J. Proscia, K. Gustin, J. Chapple-Sokol, and D. Strickler Aug. 1985 46 p
(Contract DE-AC02-83CH-10093)
(DE85-016848; SERI/STR-211-2695) Avail: NTIS HC A03/MF A01

This report presents results of research on atmospheric-pressure chemical vapor deposition (APCVD), a promising alternative deposition technique for preparing hydrogenated amorphous silicon for use in thin-film solar cells and for preparing transparent conductive electrode layers. The lack of ion bombardment, the observed high deposition rates, and the overall simplicity of the technology could mean a sizable cost reduction in the large-scale manufacturing of amorphous silicon solar cells. Solar cells with at least 8% efficiency should be possible with APCVD amorphous silicon. Titanium nitride films produced by APCVD were shown to provide low-resistance electrical contact to tin oxide and also to highly doped silicon (both p and n-type, crystalline and amorphous). DOE

N86-16730# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
OPTICAL PROPERTIES OF HIGH-TEMPERATURE MATERIALS FOR DIRECT ABSORPTION RECEIVERS
G. J. Jorgensen, P. Schissel, and R. W. Burrows Aug. 1985 10 p Presented at SPIC International Technical Symposium on Optical and Electro-Optical Engineers, San Diego, Calif. 18 Aug. 1985
(Contract DE-AC02-83CH-10093)
(DE85-012171; SERI/TP-255-2791; CONF-850887-24) Avail: NTIS HC A02/MF A01

Recent solar central receiver designs emphasize direct absorption receiver (DAR) concepts primarily because of their ability to absorb high flux densities. An attractive design utilizes molten salt as the transport/storage fluid, which is pumped to the receiver and allowed to flow over a high-temperature absorber surface. As the salt runs down the absorber surface in a thin film, concentrated solar flux heats the salt to 900 C, either directly (blackened fluid) or by convective heat transfer with the irradiated absorber (clear fluid). The feasibility of such a design depends on the optical efficiency of the absorber/fluid combination. The optical properties of candidate absorber materials and transport fluids are therefore required at appropriate elevated temperatures. Because such salts can be extremely reactive at high temperatures, it is important to measure optical properties as a function of exposure history of the salt/absorber. Optical characterization of a clear molten carbonate salt (Li2C)3-Na2CO3-K2CO3 ternary eutectic) and a high-temperature metal alloy (Inconel 600) has been carried out at elevated temperatures using a recently developed integrating sphere solar spectrometer. DOE

N86-16731# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
OPEN-CYCLE OCEAN THERMAL ENERGY CONVERSION (OTEC): STATUS AND POTENTIAL
D. Bharathan Aug. 1984 11 p Presented at US/India Binational Symposium on Solar Energy Research and Applications, Roorkee, India, 5 Aug. 1985
(Contract DE-AC02-83CH-10093)
(DE85-012169; SERI/TP-252-2757; CONF-850858-2) Avail: NTIS HC A02/MF A01

Tropical oceans with a 20 C or more temperature difference between surface and deep water represent a vast resource of renewable thermal energy. One of the methods of harnessing this resource is an open-cycle Ocean Thermal Energy Conversion (OTEC) system utilizing steam evaporated from the surface water for powering the turbine. In this paper, the state of the art of research and component development, as related to heat and mass transfer processes, power production, noncondensable gas handling, and seawater flow hydraulics, are described through an illustrated preliminary design study of a 1-MW facility. DOE

N86-16732# Florida Univ., Gainesville. Department of Botany.
RENEWABLE ENERGY: ETHANOL FROM BIOMASS
J. Thomas Mullins and Christopher C. NeSmith Aug. 1985 29 p refs Prepared for Governor's Energy Office, Tallahassee, Fla.
(TI85-902211; NP-5902211; Rept-7) Avail: NTIS HC A03/MF A01

Information is provided on the current status of both promising and proven sources of renewable energy in the State of Florida. Available conversion technologies, federal and state governmental promotion efforts, and private sector utilization of renewable energy are reviewed. Issues and factors that may advance or inhibit the greater use of renewable energy sources are identified and discussed. The public and others in government can obtain a greater understanding of the contribution, renewable energy can make in limiting our dependence on imported petroleum and other fossil fuels, which are gradually being depleted. Author

N86-16733# Iowa State Univ. of Science and Technology, Ames. Microelectronics Research Center.
CONCENTRATOR SOLAR CELL RESEARCH
P. A. Basore Jun. 1985 40 p
(Contract DE-AC04-76DP-00789)
(DE85-013941; SAND-85-7004) Avail: NTIS HC A03/MF A01

Research related to concentrator solar cells has produced a new model for series resistance and the beginnings of a powerful device analysis code for personal computers. The Quasi-One-Dimensional series resistance model permits the evaluation and optimization of losses associated with the front surface collection grid of concentrator solar cells, including nonuniform illumination profiles. The Q-1-D model has been incorporated in a computer program for the IBM PC entitled GRIS. This program permits cell designers to rapidly determine the optimum grid pattern for circular point-focus solar cells. The interactive flexibility of the personal computer is also being utilized in the development of a one-dimensional solar cell device model which numerically solves the semiconductor electron and hole transport equations. When complete, this program will be used to analyze device performance and to test the predictions of various physical models against observed cell behavior. DOE

N86-16734# Roberts Consultants, Inc., Chevy Chase, Md.
STATUS OF THE DOE BATTERY AND ELECTROCHEMICAL TECHNOLOGY PROGRAM 5
R. Roberts Jun. 1985 182 p
(Contract DE-AC06-76RL-01830)
(DE85-015241; PNL-5448) Avail: NTIS HC A09/MF A01

The program consists of two activities, Technology Base Research (TBR) managed by the Lawrence Berkeley Laboratory (LBL) and Exploratory Technology Development and Testing (EDT) managed by the Sandia National Laboratories (SNL). The status of the Battery Energy Storage Test (BEST) Facility is presented, including the status of the batteries to be tested. ECS program contributions to the advancement of the lead-acid battery and specific examples of technology transfer from this program are given. The advances during the period December 1982 to June 1984 in the characterization and performance of the lead-acid, iron/nickel-oxide, iron/air, aluminum/air, zinc/bromide, zinc/ferricyanide, and sodium/sulfur batteries and in fuel cells for transport are summarized. Novel techniques and the application of established techniques to the study of electrode processes, especially the electrode/electrolyte interface, are described. Research with the potential of leading to improved ceramic electrolytes and positive electrode container and current-collectors for the sodium/sulfur battery is presented. Advances in the electrocatalysis of the oxygen (air) electrode and the relationship of these advances to the iron/air and aluminum/air batteries and to the fuel cell are noted. The quest for new battery couples and battery materials is reviewed. New developments in the modeling of electrochemical cell and electrode performance with the approaches to test these models are reported. DOE

N86-16735# Sandia National Labs., Albuquerque, N. Mex.
PV CONCENTRATOR ARRAY FIELD PERFORMANCE MEASUREMENT
A. B. Maish 1985 10 p Presented at the PV and Isolation Measurements Workshop, Vail, Colo., 1 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-016193; SAND-85-1421C; CONF-850783-1) Avail: NTIS HC A02/MF A01

This paper discusses the procedures used to measure concentrator module and array performance at Sandia National Laboratories. It describes the method used to characterize efficiency as a function of two independent variables, direct normal insolation (DNI) and the heat sink temperature. It then investigates the uncertainty in the measured efficiency due to the choice of independent variables. The paper concludes with a review of some of the factors that must be considered in a model which used the array efficiency equation to estimate annual system energy production. DOE

N86-16736# Oak Ridge National Lab., Tenn.
COMPARATIVE STUDY OF WATER, ICE AND CLATHRATES FOR COOL STORAGE APPLICATIONS
J. J. Carbajo 1985 7 p Presented at the 20th Intersociety Energy Conversion Engineering Conference, Miami Beach, Fla., 18 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016313; CONF-850808-18) Avail: NTIS HC A02/MF A01

Cool storage systems are needed in order to reduce the large summer peak loads of many electric utilities in the United States. Cool storage systems will use off-peak electricity during the summer night and will provide air conditioning during the day requiring very little on-peak electricity. This paper describes different cool storage systems and compares the following storage media: water, ice, Refrigerant-11 clathrate, Refrigerant-12 clathrate, Refrigerant-

21 clathrate, and mixed clathrates of Refrigerant-11 and Refrigerant-12. Direct- and indirect-charged as well as direct- and indirect-discharged systems are also compared. Hybrid systems (latent and sensible heat) including ice and water, clathrate and liquid, and clathrate and liquid and salts (to reduce the freezing temperature) are also studied. It is concluded that the most appealing system, from the technical and economical point of view, is a system using mixed clathrate, liquid and salt. DOE

N86-16737# Exxon Research and Engineering Co., Linden, N.J.
CIRCULATING ELECTROLYTE ZINC/BROMINE BATTERY TEST PROGRAM AND PROCEDURES
P. Grimes 1985 10 p Presented at the International Battery Testing Workshop, Heidelberg, West Germany, 1 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE85-016996; SAND-85-7216C; CONF-851074-1) Avail: NTIS HC A02/MF A01

The Exxon circulating electrolyte zinc/bromine battery system is being co-developed by organizations in America, Europe, Japan, and Australia. The circulating electrolyte zinc/bromine battery systems have reached the multi-kilowatt hour capacity size ranges. Several 20-kWh and 30-kWh systems have been successfully tested in different modes of operation. Circulating electrolyte batteries use a test program procedure which considers the circulation system characteristics, in addition to the classical test procedures. DOE

N86-16738# Massachusetts Inst. of Tech., Brookhaven Station, N.Y. School of Chemical Engineering Practice.
EVALUATION OF THE PERFORMANCE AND APPLICATIONS OF A METAL HYDRIDE HYDROGEN COMPRESSOR
M. Klausner, J. McMillan, and D. Wickham Sep. 1984 99 p
(Contract DE-AC02-76CH-00016)
(DE85-017009; BNL-51895; MIT/BNL-84-2) Avail: NTIS HC A05/MF A01

Low-grade energy from geothermal, solar or industrial process heat sources may be utilized to power a metal hydride compressor. A four-stage compressor, containing rare-earth metal alloys, compressed 35 standard liters per minute (SLPM) of hydrogen from 0.35 MPa (45 psia) to 3.5 MPa (480 psia), using 680 kg/h (3 GPM) of 80 C water. A computer model was written to simulate compressor performance. The application of the compressor in power cycles (Brayton gas cycles), and the economics of compressor operation were examined. DOE

N86-16739# Arizona State Univ., Tempe. Coll. of Engineering and Applied Sciences.
DYNAMIC PERFORMANCE TESTING OF PROTOTYPE 3 TON AIR-COOLED CARRIER ABSORPTION CHILLER
R. R. Borst and B. D. Wood May 1985 241 p
(Contract DE-AC03-81CS-30572)
(DE85-017054; ERC-R-85013) Avail: NTIS HC A11/MF A01

The performance of a prototype three ton cooling capacity air-cooled lithium bromide/water absorption chiller was tested using an absorption chiller test facility which was modified to expand its testing capabilities to include air-cooled chillers in addition to water-cooled chillers. Temperatures of the three externally supplied fluid loops: hot water, chilled water, and cooling air, were varied in order to determine the effects this would have on the two principal measures of chiller performance: cooling capacity and thermal coefficient of performance (COP). A number of interrelated factors were identified as contributing to less than expected performance. For comparison, experimental correlations of other investigators for this and other similar absorption chillers are presented. These have been plotted as both contour and three-dimensional performance maps in order to more clearly show the functional dependence of the chiller performance on the fluid loop temperatures. DOE

N86-16740# Pacific Northwest Lab., Richland, Wash.
RESEARCH ON GEOTHERMAL CHEMISTRY AND ADVANCED INSTRUMENTATION
R. J. Robertus, D. W. Shannon, R. G. Sullivan, C. H. Kindle, and K. H. Pool Sep. 1985 7 p refs Presented at the Geothermal Program Review, Washington, D.C., 11 Sep. 1985
(Contract DE-AC06-76RL-01830)
(DE85-017915; PNL-SA-13397; CONF-8509142-3) Avail: NTIS HC A02/MF A01

Research at the Pacific Northwest Laboratory (PNL) focuses on long-term geothermal power plant reliability. Past work concentrated on development of continuous high-temperature probes for monitoring process variables. PNL also completed a comprehensive handbook of brine treatment processes as they relate to injection well longevity. A recently completed study analyzed corrosion in the hydrocarbon system of a binary cycle plant. Over the two-year monitoring period, corrosion rates were less than 1 MPY in any part of the hydrocarbon system. The system was kept completely dry so the rates seem reasonable. Present projects include: (1) determination of gas breakout conditions at the Herber Binary Demonstration Plant operated by San Diego Gas and Electric Company; (2) generation of water mixing solubility data; (3) installation of prototype leak detectors at the Herber Plant; and (4) evaluation of state-of-the-art particle counters. DOE

N86-16741# Hawaii State Dept. of Planning and Economic Development, Honolulu.
GUIDEBOOK ON PHOTOVOLTAIC APPLICATIONS IN HAWAII
R. C. Richmond Oct. 1984 121 p
(DE85-902094; NP-5902094) Avail: NTIS HC A06/MF A01

The purpose of this Guidebook is to provide the reader with a general understanding of PV power systems, their components, materials and processes; to introduce and explain PV terminology; to provide guidelines for evaluating the appropriateness of photovoltaics in specific applications; to offer a method of system sizing; and to project the future potential impact of PVs in Hawaii. DOE

N86-16742# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
EXPERIMENTAL OBSERVATIONS OF DOUBLE DIFFUSIVE NATURAL CONVECTION IN SOLAR PONDS WITH NONLINEAR SALINITY PROFILES
A. T. Kirkpatrick, R. F. Gordon, and D. H. Johnson Apr. 1985 9 p Presented at the 6th Annual ASME Solar Energy Division Technical Conference, Las Vegas, Nev., 10 Apr. 1984 Prepared in cooperation with Midwest Research Inst., Golden, CO.
(Contract DE-AC02-83CH-10093)
(DE85-000515; SERI/TP-252-2677; CONF-840402-8) Avail: NTIS HC A02/MF A01

A solar pond can be used as a thermal energy source provided that convective instabilities do not occur. This paper experimentally examines the stability of a fluid layer with nonlinear salinity profiles. A nonlinear salt profile was set up in a 0.7m x 0.7m x 1.4m deep tank, and the water was heated by a solar radiation simulator. Three experiments were conducted, each over a time scale of about one week. An instability was produced in two of the experiments. The instabilities occurred at the location of the weakest salinity gradient, and were confined to a narrow depth, as predicted by theory. A local length scale was used to produce a stability parameter, the ratio of thermal to solute Rayleigh numbers. It is shown that for nonlinear solute gradients, the appropriate length scale is based on the radius of curvature of the salinity distribution. With this choice of a length scale, good agreement was found between theory and experiment for the onset of an instability. However, only fair agreement was obtained for the disturbance frequency. DOE

N86-16743# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
FILM FLOW CHARACTERISTICS FOR DIRECT ABSORPTION SOLAR RECEIVER SURFACES
T. A. Newell, K. Y. Wang, and R. J. Copeland Jul. 1985 9 p Presented at the American Society of Mechanical Engineers Winter Annual Meeting, Miami, Fla., 17 Nov. 1985 Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-83CH-10093)

(DE85-012175; SERI/TP-252-2770; CONF-851125-10) Avail: NTIS HC A02/MF A01

A direct absorption receiver (DAR) concept offers the potential of significantly higher operating temperatures than current receiver designs. However, one of the concerns about the successful operation of DAR lies in the stability of a thin liquid-film flowing over the receiver surface. This study investigates the characteristics of a thin water film flowing over both smooth and roughened surfaces under isothermal conditions. The purpose of the smooth surface measurement is to confirm the present results with data in the literature. The roughness is obtained by attaching screens to base surface. The study shows that surface roughness has significant effects on film thickness. A simple analytical model indicates that the wall-to-film heat transfer rate for the roughened surface will also be enhanced. DOE

N86-16744# Montclair State Coll., Upper Montclair, N.J.
PARABOLIC SOLAR SYSTEMS
W. L. Parsons, IV and W. Goetchius 1985 31 p
(Contract DE-FG42-80R2-05167)
(DE85-012219; DOE/R2-05167/T1) Avail: NTIS HC A03/MF A01

The further development of parabolic solar collectors to increase their efficiency and simplify their operation was the prime objective of this research project. Three primary objectives were pursued. The first of these was to investigate the simplest and most efficient techniques to build and mass-produce parabolic solar collectors. The second objective was to further develop and simplify absorber tubes used to collect and transfer the solar energy. Absorber tubes represented a significant area of this research project. The third objective was to develop accurate, low cost, and durable tracking systems for solar collectors. Solar tracking systems are covered including several schematic representations of various systems and designs. The testing systems and associated mechanisms for the designs discussed in this report are described. DOE

N86-16745# Brookhaven National Lab., Upton, N. Y.
LOW-COST THIN-MATERIAL SOLAR TECHNOLOGY, THE KEY TO A VIABLE ENERGY ALTERNATIVE
W. G. Wilhelm and B. D. Ripel Aug. 1985 15 p Presented at the US/India Binational Symposium on Solar Energy Research and Applications, Roorkee, India, 5 Aug. 1985
(Contract DE-AC02-76CH-00016)
(DE86-000025; BNL-36815; CONF-850858-4) Avail: NTIS HC A02/MF A01

The creation of a solar technology based on a dramatic reduction in material intensity and greater simplicity of design is the result of a cost-guided research approach. It takes advantage of a progressive material science based on polymer films and unique construction methods that optimize material requirements, performance and durability. The current level of technical maturity has revealed a solar collector design that has the potential for a dramatic reduction in installed cost while maintaining high thermal performance and durability. In addition, the same methodology has guided total solar system designs with similar economies and performance advantages. DOE

N86-16746# Technical Research Centre of Finland, Espoo. Semiconductor Lab.
ANALYSIS AND MONTE CARLO SIMULATION OF LUMINESCENT SOLAR CONCENTRATORS
Arja Heinaemaeki Sep. 1985 48 p refs Sponsored by Finnish Ministry of Trade and Industry
(VTT-364; ISBN-951-38-244-X; ISSN-0358-5077) Avail: NTIS HC A03/MF A01

The applicability of inorganic materials for luminescent solar concentrators (LSCs) is investigated. The materials and the physical processes related to absorption and fluorescence are expounded and examples of materials suitable for LSCs are given. The operation of an LSC and the possible loss sources are considered. Efficiencies are defined. The Monte Carlo method is used to compare LSCs and to study how plate size, shape, and dye concentration affect the efficiencies. The efficiencies of inorganic LSCs are found to be low compared with those of organic ones, but can be improved, e.g., by codoping, material selection, and the use of multistack devices. Author (ESA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-16747 Pennsylvania Univ., Philadelphia.
TRACE METAL ACCUMULATION, DISTRIBUTION AND FLUXES IN FORESTS OF THE NORTHEASTERN UNITED STATES Ph.D. Thesis
Andrew Jay Friedland 1985 186 p
Avail: Univ. Microfilms Order No. DA8515377

Trace metals are released to the atmosphere from many anthropagenic activities and are returned to the Earth in precipitation and dry deposition. An analysis of the metal content of biomass and soil allowed an assessment of the presence of metals in forests. Forest floor was sampled at 78 sites in nine northeastern states in the USA and analyzed for Cu, Zn, Ni and Cd. Higher levels of trace metals occurred in the southern half of the study region. Earlier work identified that Pb accumulated in the forest floor of the high-elevation regions of New England. The distribution of Pb, Cu, Zn, Ni and Cd within the forest floor was studied at three different forested states in New England. The greatest concentration of Pb, Cu, Zn, Ni and Cd occurred in the Oe horizon of the forest floor in all three-forest. This is the zone of greatest biological activity in the forest floor. Cadmium behaved differently in all three forests. Because it receives relatively high rates of atmospheric deposition, Camels Hump in northern Vermont was studied in greater detail. Dissert Abstr.

N86-16748*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRBORNE LIDAR MEASUREMENTS OF AEROSOLS, MIXED LAYER HEIGHTS, AND OZONE DURING THE 1980 PEPE/NEROS SUMMER FIELD EXPERIMENT
Edward V. Browell, Scott T. Shipley, Caolyn F. Butler (Old Dominion Univ., Norfolk, Va.), and Syed Ismail (SASC Technologies, Inc., Hampton, Va.) Dec. 1985 197 p refs
(NASA-RP-1143; L-15943; NAS 1.61:1143) Avail: NTIS HC A09/MF A01 CSCL 13B

A detailed summary of the NASA Ultraviolet Differential Absorption Lidar (UV DIAL) data archive obtained during the EPA Persistent Elevated Pollution Episode/Northeast Regional Oxidant Study (PEPE/NEROS) Summer Field Experiment Program (July through August 1980) is presented. The UV dial data set consists of remote measurements of mixed layer heights, aerosol backscatter cross sections, and sequential ozone profiles taken during 14 long-range flights onboard the NASA Wallops Flight Center Electra aircraft. These data are presented in graphic and tabular form, and they have been submitted to the PEPE/NEROS data archive on digital magnetic tape. The derivation of mixing heights and ozone profiles from UV Dial signals is discussed, and detailed intercomparisons with measurements obtained by in situ sensors are presented. Author

N86-16749# Rijksluchtvaartdienst, The Hague (Netherlands).
REPORT OF THE WORKING GROUP FOR SENSITIVITY ANALYSIS AND ZONING CALCULATIONS (GAZOB) Final Report [EINDRAPPORT VAN DE WERKGROEP GEVOELIGHEIDSANALYSE ZONERINGSBEREKENINGEN (GAZOB)]
May 1985 91 p refs In DUTCH
Avail: NTIS HC A05/MF A01

The sensitivity of noise pollution calculations to the input data for Schiphol airport was analyzed. Noise pollution calculations for Schiphol airport are reviewed. For individual titles, see N86-16750 through N86-16751.

N86-16750# Rijksluchtvaartdienst, The Hague (Netherlands).
[ANALYSIS AND CONCLUSIONS OF THE WORKING GROUP FOR SENSITIVITY ANALYSIS AND ZONING CALCULATIONS (GAZOB)] Final Report
In its Report of the Working Group for Sensitivity Analysis and Zoning Calculations (GAZOB) May 1985 42 p In DUTCH (For primary document see N86-16749 07-45)
Avail: NTIS HC A05/MF A01

The sensitivity of noise pollution calculations to the input data system was analyzed in the area of Schiphol airport with a consideration for housing construction plans, based on the present runway system for the situation expected around 1990 and later. The analysis allows a better insight into the variation of factors which contributes to noise pollution calculations. The only free parameters for the choice of a zone contour are shown to be the fleet composition and the number of aircraft movements. The possible conditions in 1995 and 2000 are calculated and show a substantial noise reduction the planned improvements. It is concluded that a regional zoning for home construction based on the contours calculated for 1990 is justified. Author (ESA)

N86-16751# National Aerospace Lab., Amsterdam (Netherlands). Afdeling Vliegtuigen.
NOISE NUISANCE CALCULATIONS FOR SCHIPHOL AIRPORT ON BEHALF OF THE SENSITIVITY ANALYSIS AND ZONING CALCULATIONS WORKING GROUP (GAZOB) [GELUIDSBELASTINGBEREKENINGEN VOOR DE LUCHTHAVEN SCHIPHOL TBV DE WERKGROEP GAZOB]
H. J. Poutsma *In* Rijksluchtvaartdienst Report of the Working Group for Sensitivity Analysis and Zoning Calculations (GAZOB) May 1985 48 p refs In DUTCH (For primary document see N86-16749 07-45)
(Contract RB-RLD-1984/1985:5.2)
(NLR-TR-85034-U) Avail: NTIS HC A05/MF A01

Starting points and results of noise pollution calculations for the Schiphol airport are reviewed. Calculation procedure, aircraft data, runway structure, aircraft motions, and test flights are explained. The results of calculations are presented as noise pollution contours. Author (ESA)

N86-16752# Oak Ridge National Lab., Tenn.
ACID DEPOSITION AND THE ACIDIFICATION OF SOILS AND WATERS
J. O. Reuss and D. W. Johnson 1985 256 p
(Contract DE-AC05-84OR-21400)
(DE85-016544; DOE/OR-21400/T161) Avail: NTIS HC A12/MF A01

A conceptual model of acid deposition is presented consistent with established physiochemical principles and the bulk of available information. The authors seek to provide insight into probable long-term effects of acid deposition; a testable hypotheses; plus design and interpretation of the research. DOE

N86-16753# Geological Survey, Reston, Va.
WATER QUALITY OF THE TIDAL POTOMAC RIVER AND ESTUARY: HYDROLOGIC DATA REPORTS SUPPLEMENT, 1979 THROUGH 1981 WATER YEARS
Richard H. Coupe, Jr. and Wayne E. Webb 1984 356 p
(TI86-900061; USGS-OFR-84-132) Avail: NTIS HC A16/MF A01

This is a companion report to the U.S. Geological Survey 1979, 1980, and 1981 hydrologic Data Reports of the tidal Potomac River and estuary. The information included contains values of biochemical oxygen demand and specific-rate constants, incident-light and light-attenuation measurements; number of phytoplankton, fecal coliform and fecal streptococci; cross-sectional averages from field measurements of dissolved oxygen, pH, specific conductance, and temperature data; and cross-sectional averages of chlorophyll data. Sewage-treatment plant loads are also included. Author

N86-16754# Pacific Northwest Lab., Richland, Wash.
A METHOD TO CHARACTERIZE LOCAL METEOROLOGY FOR AIR POLLUTION STUDIES AND EMERGENCY RESPONSE NEEDS
C. G Lindsey and C. S. Glantz Oct. 1984 5 p refs Presented at the 4th Joint Conference on Applied of Air Pollution Meteorology, Portland, Oreg., 15-19 Oct. 1984
(Contracts DE-AC06-76RL-01380; NRC-FIN-B-2182)
(TI85-002538; PNL-SA-12122; CONF-851059-15) Avail: NTIS HC A02/MF A01

A simple weather-typing model has been used to correlate synoptic-scale atmospheric systems with local meteorology in shoreline and complex terrain environments. The climatological characteristics of local winds and stability criteria can be deduced by stratifying site data according to the prevailing synoptic features, season, and time of day. Synoptic conditions that control local meteorology and inhibit the formation of mesoscale circulations have been isolated. Similarly, synoptic systems that favor the development of the sea/lake land breeze or mountain/valley wind system have been determined. The characteristic response of the local meteorology to each type of system can be described once available data are stratified by the parameters given in the model. Author

N86-16755# Rhode Island Univ., Narragansett. Graduate School of Oceanography.
ELEMENTAL TRACERS OF SOURCE REGIONS OF CONTAMINANTS IN PRECIPITATION Third Quarterly Report, 1 Nov. 1984 - 31 Oct. 1985
K. A. Rahn 27 Aug. 1985 32 p
(Contract DE-FG22-84PC-71253)
(DE85-017182; DOE/PC-71253/3) Avail: NTIS HC A03/MF A01

The general directions of effort discussed in the second quarterly report are continuing satisfactorily: each rain at Narragansett is being collected and analyzed with its corresponding aerosol samples. The rain-sampling procedure is being improved. We have begun to cooperate with Dr. R. Borys of Colorado State University on a study of how the chemistry of snow and cloud water in northwestern Colorado is affected by cloud physics. We will present papers on the results of our DOE project at two conferences in late 1985. K. Rahn has been invited for a return visit to China in October and November 1985, for the express purpose of expanding a cooperative project concerned with using elemental tracers to determine source areas of acid rain in southwestern China. Each of these topics is discussed in detail. DOE

N86-16756# Lawrence Livermore National Lab., Calif.
CLIMATIC RESPONSE TO LARGE SUMMERTIME INJECTIONS OF SMOKE INTO THE ATMOSPHERE: CHANGES IN PRECIPITATION AND THE HADLEY CIRCULATION
S. J. Ghan, M. C. MacCracken, and J. J. Walton Aug. 1985 43 p refs Presented at the International Association for Meteorology and Atmospheric Physics, Honolulu, Hawaii, 5 Aug. 1985
(Contract W-7405-eng-48)
(DE86-000018; UCRL-92324; CONF-8508131-1) Avail: NTIS HC A03/MF A01

An atmospheric general circulation model (AGCM) has been initialized with a 150 Tg summertime injection of smoke from post-war fires over Europe, Asia and North America. The smoke is subject to large-scale and convective transport, dry deposition, coagulation and precipitation scavenging. The Hadley circulation is shown to respond in three stages. In the first stage, which lasts about one week depending on initial conditions, the Hadley circulation doubles in intensity. As the smoke spreads across the equator, and as the troposphere becomes more stable, the Hadley cell then weakens until it becomes actually weaker than in the control climate. In the final stage, as the smoke is removed, the Hadley cell gradually returns towards the control. Surface precipitation generally decreases as a result of the smoke. By the fourth week following the injection, zonal-mean surface precipitation in the tropics and summer hemisphere midlatitudes are about half of those in the control climate. The decrease is most notable over land, ocean precipitation being reduced only in the tropics. Penetrating convective precipitation is greatly reduced at all latitudes; large-scale precipitation is enhanced, becoming the dominant mode of precipitation in the simulation. Precipitation

scavenging is shown to be the dominant removal process for particles larger than one micron in diameter. As a result, the lifetime of large particles increases several-fold due to the reduction in precipitation and the self-lofting of the smoke. For particles smaller than one micron in diameter, precipitation scavenging is found to be a much less efficient removal mechanism than both coagulation, which is important during the first week following the injection, and dry deposition at later times. DOE

N86-16757# Rolls-Royce Ltd., Derby (England). Noise Technology Div.

AIRCRAFT NOISE CONTROL: PROSPECTS FOR THE 21ST CENTURY

M. J. T. Smith 23 Jul. 1985 10 p Presented at 52nd National Society for Clean Air Conference, Scarborough, England, Oct. 1985

(PNR-90272) Avail: NTIS HC A02/MF A01

The background, policies and prediction of the evolution of aircraft noise control technology are discussed. The probable world fleet composition through to the end of the century is analyzed. Domination of turbofan technology is foreseen by 1988. Examples of recent developments are examined for goals on the order of 95 to 100 dB. Author (ESA)

N86-16758# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.

INITIALIZATION OF THE EULER MODEL MOMENT DISTRIBUTION (MODIS) WITH FIELD DATA FROM THE EPRI PLUME MODEL VALIDATION PROJECT

G. Petersen, D. Eppel, M. Lautenschlager, and A. Mueller 1985 22 p refs Presented at the 15th International Technical meeting on Air Pollution and its Applications, St. Louis, Mo., 15-19 Apr. 1985

(GKSS-85/E/18; ISSN-0344-9629) Avail: NTIS HC A02/MF A01

The Moment Distribution program was designed as an operational tool for modeling the dispersion of a point source under general atmospheric conditions. The concentration distribution is determined by calculating its crosswind moments on a vertical grid oriented in the main wind direction. The model contains a parametrization for horizontal and vertical diffusion coefficients based on a second order closure model. The Eulerian time scales determined by fitting measured plume cross sections are confirmed by comparison with data from the EPRI plume model validation project. Author (ESA)

N86-16759# Environmental Sciences Research Lab., Research Triangle Park, N.C. Meteorology and Assessment Div.

COMPARISON OF RAM (REGIONAL AIR MONITOR) MODEL ESTIMATES OF 1976 ST. LOUIS RAPS (REGIONAL AIR POLLUTION STUDY) MEASUREMENTS OF SULFUR DIOXIDE

D. B. Turner, J. S. Irwin, and A. D. Busse 1985 8 p Submitted for publication

(PB85-225639; EPA-600/J-85-072) Avail: NTIS HC A02/MF A01 CSCL 13B

Estimates from the model RAM were compared with actual SO2 measurements from 13 Regional Air Pollution Study (RAPS) sites in St. Louis for 1976, with particular emphasis on the second highest concentrations for the 1-h, 3-h, and 24-h averaging times; the average annual concentration; and the top 5% of the distribution for the 24-h concentrations. Although there was considerable scatter in the comparison of the second highest concentrations, only 8 of the 39 data points were outside the bounds of a factor of two, and although there was more underestimation by the model as the averaging time increased, no overall bias was seen. Exponential distributions fit the top 5% of the 24-h concentration distributions for all sites for both the estimated and measured concentrations. The distributions for the estimated and measured concentrations matched at 8 of the 13 sites. Author (GRA)

N86-16760# Environmental Research Lab., Gulf Breeze, Fla.

PROCEEDINGS OF THE WORKSHOP: BIODEGRADATION KINETICS

A. W. Bourquin, P. H. Pritchard, W. W. Walter, and R. Parrish Jun. 1985 171 p Proc. held at Navarre Beach, Fla., 18-20 Oct. 1983

(PB85-222651; EPA-600/9-85-018) Avail: NTIS HC A08/MF A01 CSCL 06A

Biodegradation Kinetics examined future directions and focus of scientific investigations of the kinetic aspects of microbial degradation rates of organic chemicals in natural environments. The following topics were presented: (1) statistical and experimental requirements for modeling decay curves; (2) the second order approach assumption, limitations and research needs; (3) factors controlling biodegradation rates in microbial communities; (4) application of uptake and mineralization kinetics; (5) relationships between chemical structure and biodegradation rates; and (6) extrapolation of laboratory biodegradation data to the field. The direction and extent of research required for the description of biodegradation rates of xenobiotic chemicals in natural environments is discussed. GRA

N86-16761# Sonoma Technology, Inc., Santa Rosa, Calif.

CHARACTERIZATION OF THE COMPOSITION AND THREE DIMENSIONAL DISTRIBUTION OF ACIDITY IN SOUTHERN CALIFORNIA CLOUDS Final Report

L. W. Richards, J. A. Anderson, D. L. Blumenthal, and J. A. McDonald Apr. 1985 156 p Sponsored by California State Air Resources Board, Sacramento

(PB85-223014; STI-90083-506-16FR; ARB-R-85-249) Avail: NTIS HC A08/MF A01 CSCL 04A

Samples of water and aerosol were collected and trace gas concentrations and other air quality parameters in stratus clouds both in the coastal and inland portions of the Los Angeles Basin were measured. Three flights were made in October and November 1983 and 3 in June 1984. The analytical procedures were designed to emphasize the determination of the concentrations of sulfur species and species which may play an important role in the chemistry of sulfur compounds. It was found that except in two isolated plumes, the conversion of sulfur dioxide to sulfate had gone to completion in the clouds and that a very effective oxidant, hydrogen peroxide, remained in excess in the cloud water. GRA

N86-16762# Florida Univ., Gainesville. Dept. of Soil Science.

EFFECTS OF ACID PRECIPITATION ON A TYPIC QUARTZIPSAMMENT SOIL IN FLORIDA

B. G. Volk and G. E. Byers Aug. 1985 22 p

(PB85-236495; EPA-600/D-85-175) Avail: NTIS HC A02/MF A01 CSCL 08M

The magnitude of leaching of nutrients from the soil surface to the water table and to a nearby drainage system depends on many factors unique to the site. The sensitive deep sands of Florida present an extreme case of low nutrient status and high water flux to great depth. In addition, water table characteristics, both physical and chemical, influence the horizontal flow vis-a-vis the vertical flows. The magnitude of leaching also depends on the nature of the ion, the depth being considered and the acid treatment. Readsorption of ions in the soil profile was shown to occur which further complicates the overall assessment of the real effect of acid rain. The effect of acid rain is not long lasting and the soils recover the normal soil leachate chemistry within 48 hours. GRA

N86-16763# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.

INTERNATIONAL SULFUR DEPOSITION MODEL EVALUATION: 1980 STANDARD MODEL INPUT DATA SET

T. L. Clark, D. H. Coventry, B. K. Eder, C. M. Benkovitz, and V. A. Evans 1985 16 p Prepared in cooperation with the Department of the Environment, Ottawa, Ontario and Brookhaven National Lab., Upton, N.Y.

(PB85-210847; EPA-600/D-85-112) Avail: NTIS HC A02/MF A01 CSCL 04A

North American meteorological and sulfur emissions data for 1980 have been processed to serve as input data to regional acid deposition models participating in the International Sulfur

Deposition Model Evaluation (ISME) Project. Using these data sets, 15 regional acid deposition models are to simulate seasonal and annual ambient concentrations and dry and wet deposition amounts of sulfur dioxide and sulfate. As the main objective of the ISDME Project, simulated sulfur wet deposition amounts are to be compared to measurements at selected sites of five North American precipitation chemistry networks. Discussions focus on the data processing procedures and the 1980 model input data sets. GRA

N86-16764# Vermont Univ., Burlington. Water Resources Research Center.
CHARACTERIZATION OF ALUMINUM CHEMISTRY FOR ACID PRECIPITATION
D. R. Hemenway and B. Fitzgerald 1 Dec. 1984 28 p Sponsored in part by Geological Survey, Reston, Va.
(PB85-214542) Avail: NTIS HC A03/MF A01 CSCL 07D

Aluminum has come under increasing scrutiny as a toxic element either being released by acid precipitation interaction with soils or by being transported in the primary precipitation event. The study describes several analytical techniques for quantitatively evaluating the form of aluminum. A unique method of using molecular weight (mw) cut-off filtration and the 8-hydroxy quinulate extraction technique to assess monomeric aluminum speciation has been developed. A cut-off mw filter of 50,000 was found to be effective in separating monometric aluminum from other aged forms of polymeric species found in precipitation. GRA

N86-16449# University of Electro-Communications, Tokyo (Japan).
CARBON DIOXIDE IN THE ATMOSPHERE
Nobuhide Kokubu, Sigeru Kumagai, and Akira Miyazaki *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 87-91 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-16765 Washington Univ., Seattle.
A NUMERICAL STUDY OF THE DISTRIBUTION AND TRANSPORT OF OZONE IN THE STRATOSPHERE Ph.D. Thesis
Ben Jonq-Dao Jou 1985 329 p
Avail: Univ. Microfilms Order No. DA8508062

A three-dimensional, semi-spectral, numerical model based on the primitive equations in the spherical, log-pressure coordinate system, is used to study the distribution and transport of ozone in the stratosphere. In the first part of the experiment, ozone transport by quasi-stationary, dissipative planetary waves and its role in maintenance of the zonal mean ozone distribution in the winter stratosphere is studied. Ozone budget is analyzed by using the transformed Eulerian-mean formulation. The mechanisms of ozone transport in the stratosphere can roughly be classified into three regimes in the vertical direction, according to the effectiveness of photochemical processes. In the upper stratosphere, the deviations of zonal mean ozone from its photochemical equilibrium state are found to be significant only near the latitudes where large meridional gradient of ozone photochemical relaxation rates are present. In the lower stratosphere, the net ozone change can be described fairly well by the residual mean circulation. Dissert. Abstr.

N86-16766 Wisconsin Univ., Madison.
THE VARIATIONAL FOUR-DIMENSIONAL ASSIMILATION OF ANALYSES USING FILTERED MODELS AS CONSTRAINTS Ph.D. Thesis
John Charles Derber 1985 162 p
Avail: Univ. Microfilms

A new variational four-dimensional data assimilation technique is developed using filtered models as constraints. The assimilation method uses standard nonlinear minimization techniques to iteratively find the solution to the constraining forecast model which best fits the data. The sensitivity of the method to various parameters is examined using a quasigeostrophic channel model. The method is relatively sensitive to the length of the assimilation interval. Temporally correlated errors are shown to substantially reduce the method's effectiveness. It is indicated that the use of an imperfect constraining model may not be very detrimental to the final analyses especially in the center of the analysis interval. A 10 level quasigeostrophic model is used to assimilate analyses created from satellite measured radiances for two cases. Little adjustment occurred in either case indicating the analyses correctly describe the atmospheric state or contain temporally correlated errors. However, the assimilation technique still produced realistic results. Generally, the assimilation technique appeared to be very well behaved and has the potential to be quite useful in numerical weather prediction. Dissert. Abstr.

N86-16767 Oregon State Univ., Corvallis.
AGE PROGRESSIVE VOLCANISM IN THE COMORES ARCHIPELAGO AND NORTHERN MADAGASCAR Ph.D. Thesis
Christina Marie Emerick 1985 235 p
Avail: Univ. Microfilms Order No. DA8514822

The Comores islands and Tertiary volcanic province of Northern Madagascar form a sub-linear trend of alkalic shield volvanoes across the northern Mozambique Channel. Potassium-argon dating of shield building lavas confirms an eastward increase in age of volcanism along the chain, consistent with a hotspot origin for the lineament. The rate of migration of the Somali Plate over the mantle source is approximately 45 mm/yr. This new geochronology for the Comores island chain is used to model the absolute motion of the Somali Plate for the last 10 million years. A systematic departure of the Somali Plate absolute motion from the African Plate absolute motion during this period represents a component of relative motion across the East African Rift at the rate of .330 deg/m.y., about an Euler pole located at 63.6 deg. S,2.3. deg. E. The geometry of older portions of the Comores and Reunion trends indicates that there was no significant relative motion between the African and Somali Plates prior to about 10 m.y. ago. Sequential reconstructions from 200-0 m.y. are presented. Dissert. Abstr.

N86-16768 Yale Univ., New Haven, Conn.
PATTERNS AND DYNAMICS OF LATE CRETACEOUS MARGINAL MARINE SEDIMENTATION; OVERTHRUST BELT, SOUTHWESTERN WYOMING Ph.D. Thesis
David Trowbridge Lawrence 1984 602 p
Avail: Univ. Microfilms Order No. DA8509715

A comprehensive surface and subsurface study of the Upper Cretaceous Hinshaw Member of the Hillard Shale, Lazeart Sandstone Member of the Adaville Formation, and Adaville Formation reveals a complex intertonguing of marine and nonmaine strata. Observations of the lithostratigraphy and facies of the Hinshaw-Adaville sequence provide the basis for a conceptual model of marginal marine foreland basin sedimentation. The distribution, thickness, geometry, and cyclicity of marginal marine strata were determined by: (1) geographic position relative to active distributary channels and channel margin facies; (2) differential compaction of subjacent sediments; (3) magnitude and geographic extent of transgressive-regressive pulses; (4) sediment load and subsidence; (5) number of transgressive-regressive pulses; and (6) thrust load; eustasy, and sediment input in the foreland basin adjacent to the Sevier orogenic belt. Thickness of strata, grain size and sand percent decrease away from channels, and thickness and lateral continuity of coal increase. Continuous processes produced nonrandom vertical sequences; random vertical sequences were produced by discontinuous processes. Dissert. Abstr.

N86-16769 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ANALYSIS AND INTERPRETATION OF COMPRESSIONAL

(P-WAVE) AND SHEAR (SH-WAVE) REFLECTION SEISMIC AND GEOLOGIC DATA OVER THE BANE DOME, GILES COUNTY, VIRGINIA Ph.D. Thesis
Mark Joseph Gresko 1985 97 p
Avail: Univ. Microfilms Order No. DA8511939

Approximately 37 km of predominantly 24-fold p-wave Vibroseis data and 16 km of 24-fold SH-wave Vibroseis data were acquired the southern portion of the folded Appalachians near the Bane Dome in Giles County, Virginia. Data processing techniques included the application of newly developed methods for crossdip removal as well as the determination of static solutions in the case of time variant shifts within the data traces. Minimum-phase filter deconvolution was also applied for the removal of reverberating energy and multiples recorded on the SH-wave lines. V sub p/ V sub s ratios were used to aid in the determination of lithologies in the absence of bore-hole data. Interpreted thicknening of the Lower Cambriano to Upper Precambrian sequence beneath the Bane Dome appears to represent Eocambrian rifting. Faults generated at that time may now be reactivated by the present stress regime, causing earthquake activity in this area. Interpretation of the seismic data supports a duplex structure proposed for the Paleozoic rocks of the Bane Dome Complex within the Narrows thrust sheet of southwestern Virginia. Dissert. Abstr.

N86-16770 California Univ., Santa Barbara.
PALEOMAGNETISM OF THE MONTEREY FORMATION IN THE WESTERN TRANSVERSE RANGES, CALIFORNIA Ph.D. Thesis
John Scott Hornafius 1984 465 p
Avail: Univ. Microfilms Order No. DA8509432

Dolomites and limestones in the Monterey Formation generally possess either a stable primary magnetic remanence acquired prior to Plio-Pleistocene folding, or a stable secondary magnetic remanence acquired subsequent to Plio-Pleistocene folding. The primary remanence is carried by detrital magnetite, whereas the secondary remanence is carried by authigenic magnetite + or - hematite. A paleomagnetic investigation was conducted on dolomite beds in live stratigraphic sections of the middle and upper Miocene Monterey Formation exposed along the coastline between Santa Barbara and Point Conception (42 beds, 290 samples). Dolomites 14.8 to 15.8 m.y. old have a mean magnetic declination of 92 + or -7 deg., whereas dolomites 8 to 12 m.y. old have mean magnetic declination of 36 deg + or - deg. The consistent upsection decrease in magnetic declination within these stratigraphic sections is attributed to a rapid 56 + or - 10 deg clockwise rotation of the entire Santa Ynez Range between 15.2 and 10 m.y.b.p.
Dissert. Abstr.

N86-16771 Pennsylvania Univ., Philadelphia.
PHANEROZOIC TECTONO-THERMAL HISTORY OF THE NUBIAN MASSIF, EASTERN DESERT, EGYPT, AND IT RELATIONSHIP TO THE OPENING OF THE RED SEA AS REVEALED BY FISSION-TRACK STUDIES Ph.D. Thesis
Gomaa Ibrahim Omar 1985 164 p
Avail: Univ. Microfilms Order No. DA8515431

Seventy-nine fission-track ages are reported on apatite, sphene, and zircon recovered from Eo-Cambrian to Cretaceous ring complexes and Precambrian granites, Eastern Desert, Egypt. With respect to the ring complexes, zircon and sphene ages are concordant with K/Ar and Rb/Sr emplacement ages, signifying rapid cooling following instrusion. Apatite ages, except for Abu Khruq, are significantly younger than the emplacement ages and are interpreted as uplift ages. Annealing of the apatite clocks is attributed to a combination of cauldron subsidence, sedimentary burial, and an increase in regional heat flow. Combining ages on the ring complexes and the granites suggests that, block faulting was important in the dynamics of the uplift history since early Late Paleozoic time. Four major blocks were identified in southeastern Egypt. Uplift along major faults affected blocks of regional dimensions. It appears that, the updoming preceding the rifting stage of the Red Sea took place in two stages: the earlier and more widespread phase occurred during Late Cretaceous, the later in Early Oligocene time. Total duration of the two stages prior to the initiation of the opening of the Red Sea was about 50 m.y. A time-table for events related to the rifting stage in the Eastern Desert is also presented. Dissert. Abstr.

N86-16772 Colorado State Univ., Fort Collins.
EXPERIMENTAL STUDY OF ALLUVIAL FANS Ph.D. Thesis
William E. Weaver 1984 538 p
Avail: Univ. Microfilms Order No. DA8515202

The role of geomorphic thresholds in the short term operation and long term evolution of alluvial fans was examined. A theoretical, cyclic pattern of alluvial fan evolution, involving apex sedimentation, followed by channel incision and a longer period of lateral channel migration and backfilling, was confirmed. The regularity and predictability of cyclic changes in spatial sedimentation patterns increased as mudflows became more important. When mudflows were the primary agent, apex slopes were steep and unstable under intervening streamflow conditions. It is suggested that the alluvial fans of an area will display a myriad of contrasting morphologic forms, even if they were not subject to a change in external conditions. Incongruous morphologic responses of fans in Idaho imply differing levels of landform stability existed at the last major change in conditions. Changes in external variables may affect the stability of alluvial fans by either physically altering the landform relative to an unchanging threshold value or by modifying the threshold value of one of the variables which controls fan response. Instead of controlling landform behavior, external stimuli act within the cyclic framework of landform development to merely hasten or delay the conclusion of one cycle and the initiation of the next. Dissert. Abstr.

N86-16773 Oregon State Univ., Corvallis.
NUMERICAL SIMULTION OF PLANETARY BOUNDARY-LAYER EVOLUTION AND MESOSCALE FLOW OVER IRREGULAR TERRAIN UNDER DAYTIME HEATING CONDITIONS Ph.D. Thesis
Kyozo Ueyoshi 1985 298 p
Avail: Univ. Microfilms Order No. DA8514829

The influence of irregular terrain on the evolution of the daytime planetary boundary layer (PBL) and meso-beta scale dry circulations is studied using two three-dimensional hydrostatic beta-coordinate models with different approaches for the PBL parameterizations; the 4-layer model uses the mixed-layer (bulk-layer) approach, while the 7-layer model uses the mixed-layer (bulk-layer) approach, while the 7-layer model adopts the eddy-diffusivity (multi-layer) approach. Numerical experiments are carried out under the conditions of a dry, sunny summer day with moderate prevailing westerly winds blowing over gently sloping idealized hills in a domain of 150 km on a side. The results from the two models are compared and their performances are evaluated. The behaviors of the mean PBL depth and inversion strength are analytically described using a simple one-point mixed-layer model. Counterclockwise rotation of the mean PBL winds with time observed in both model results can be explained only when the non-zero momentum flux at the PBL top is taken into account.
Dissert. Abstr.

N86-16774 Rice Univ., Houston, Tex.
MULTIPLE FREQUENCY BACKSCATTER OBSERVATIONS OF HEAT-INDUCED FIELD-ALIGNED STRIATIONS IN THE AURORAL E REGION Ph.D. Thesis
Stephen T. Noble 1985 164 p
Avail: Univ. Microfilms Order No. DA8517228

The mechanisms by which high-power HF radio waves produce geomagnetic ield-aligned striations (FAS) in the auroral E region were examined. During periods of full power O-mode heating, striations having peak cross sections of 40 to 50 dBsm are observed. Striations are not detected during times of X-mode heating. When the heater output is varied a corresponding change in the cross section is measured. The magnitude of the change is most pronounced for heater level changes in the range 12.5 to 50% of full power. These cross sections are significantly larger than those measured at midlatitudes using the Arecibo heater. The growth and decay times of the striations are frequency

dependent. The growths are variable and can range up to a few seconds if the ionospheric conditions are only marginal for striation development. Dissert. Abstr.

N86-16775 California Univ., Los Angeles.
TECTONIC INTERPRETATION OF LEVELING DATA IN SOUTHERN CALIFORNIA Ph.D. Thesis
Chi-Ching Liu 1985 220 p
Avail: Univ. Microfilms Order No. DA8516824

Systematic errors, such as refraction error, rod calibration error, and magnetic effects on leveling instruments are always troublesome in leveling interpretations. Kukkamaki's refraction formula, which was developed in Europe, requires temperature observations on at least two different heights above the ground for each setup. But the leveling surveys before 1980 in southern California had temperature observations at only one height. A refraction test survey from Saugus to Vincent in southern California showed that Kukkamaki's formula is useful, However, some numerical parameters estimated from Europena temperature measurements, and commonly used in the U.S., are not appropriate for southern California. As a result, the magnitude at the refraction error has been underestimated until now. From temperature observations in the 1980 test survey, linear relationships were also found among temperature and its first and second derivatives. Dissert. Abstr.

N86-16776 Louisiana State Univ., Baton Rouge.
INVERSE SPECTRAL MODELING OF GEOPOTENTIAL FIELDS OVER SEDIMENTARY BASINS Ph.D. Thesis
Michael Terry Angelich 1985 126 p
Avail: Univ. Microfilms Order No. DA8517722

Interpretation of geopotential data using inverse spectral modeling techniques eliminates the ambiguous results produced by the standard forward-modeling approach. However, applying the spectral modeling procedures by hand is time-consuming and lacks precision. This study expands on current spectral analysis techniques by adding least-squares statistical rigor to the fitting of the chosen model. Automating the model fitting procedure allows an investigator to examine quickly many overlapping sections (windows) of mapped data. Successive overlapping of neighboring windows suggest a correlation between the ensemble-average depth solutions unique to each window is possibe. This technique was shown to be especially useful in Louisiana and west Mississippi, where the thick sedimentary cover and relatively smooth anomallous geopotential fields insure correlation between successive windows. The correlated depth solutions appear to correspond well with horizons located by seismic refraction and inferred from hydrocarbon exploration studies. Dissert. Abstr.

N86-16777 Rice Univ., Houston, Tex.
STRUCTURE OF THE NORTHERN SIERRA NEVADA, CALIFORNIA Ph.D. Thesis
William Jay Schmidt 1985 272 p
Avail: Univ. Microfilms Order No. DA8517233

Structural features on megascopic, mesoscopic, and microscopic scales have been examined in a study area located in the central portion of the northern Sierra Nevada (west of Lake Tahoe). Structures observed within the study area are correlated with regional deformational events of the northern Sierra Nevada. Although at least four regionally extensive deformational events have affected the rocks of the northern Sierra Nevada, the effect of only three events are recognized in the study area. Structures associated with post-Ordovician/Silurian and pre-late Devonian deformation were not identified due to overprinted of later deformational events. There is ample evidence supporting extensive late Paleozoic-early Mesozoic deformation in the study area. Structures from this event formed as the result of compressive deformation along a northwest-striking, east-dipping convergent plate boundary along the western margin of the Sierra province and may be related to the accretion of strike-slip motion may have existed along the plate boundary, the structures appear to be related to the normal component of convergence.
Dissert. Abstr.

N86-16778 California Univ., Santa Barbara.
APPLICATIONS OF IMAGING RADAR TO GEOLOGY Ph.D. Thesis
MIcheal Irvin Daily 1985 339 p
Avail: Univ. Microfilms Order No. DA8517877

Tone, texture, and features imaged by radars were studied. A variety of computer image processing techniques were developed to reveal characteristics of these scences. Field checking of sites suggests links between the geology and the images. Tonal studies examine the effects of varying frequency polarization, and illumination geometry. Most surficial geologic units in Death Valley, California, are distinguishable by use of multifrequency, multipolarization radar data. Quaternary basalt flows in Idaho are separable by changing illumination geometry in the vertical plane, whereas desert fans and dunes show little tonal variation as function of changing illumination aximuth. Topographic texture is strongly enhanced by radar's unusual imaging physics computer image processing techniques prove useful in classifying and enhancing image texture. The classification technique, yield results in good agreement with those of human interpreters. The enhancement technique resolves a plunging anticline that was not evident on unprocessed imagery. Identification of features such as lineaments and large topographic highs is critically dependent on radar system parameters. A mathematical model of topography-induced distortion provides insight into the relationship between a radar image and the illuminated terrain. Imaging radar is shown to be a useful sensor for geologic mapping, especially when complementary data are present. Careful image processing, field checking of interpretations, and an understanding of radar imaging physics are critical to effective utilization of this unusual sensor. Dissert. Abstr.

N86-16779 Institut d'Aeronomie Spatiale de Belgique, Brussels.
RECENT STRATOSPHERIC NEGATIVE ION COMPOSITION MEASUREMENTS BETWEEN 45 AND 22 km ALTITUDE
E. Arijs, D. Nevejans, J. Ingels, and P. Frederick 1984 29 p refs Presented at 7th International Conference on Atmospheric Electricity, Albany, N.Y., 3-8 Jun. 1984 Submitted for publication Sponsored by Belgian National Science Foundation
(Aeronomica-Acta-A-283-1984) Avail: Issuing Activity

Negative ion composition in the stratosphere was measured between 22 and 45 km altitude with a balloon-borne quadrupole mass spectrometer. At high altitudes the ion spectra may be disturbed by contamination, whereas at low altitudes ion cluster break up is a severe problem. The relative abundances of the different ion mass peaks, mainly belonging to the N(O-)3 (HNO3) and HS(O-)4 (HNO3)m (H2SO4)l cluster families allow the derivation of concentrations of H2SO4. At 45 km an increased SO2 mixing ratio, possibly due to volcanic activities, is estimated. The data are discussed in terms of previous measurements and models. Sulfur chemistry is considered. Author (ESA)

N86-16780# Geological Survey, Washington, D.C.
GEOLOGIC DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTES: EARTH-SCIENCE PERSPECTIVES
J. D. Bredehoeft, A. W. England, D. B. Stewart, N. J. Trask, and I. J. Winograd 1985 20 p refs
(GS-Circ-779; LC-78-600019) Avail: NTIS HC A02/MF A01

The long term storage of radioactive waste and its geological, biological, physical, and chemical effects are considered. The development of acceptable waste repositories are outlined: (1) identification of sites that meet broad criteria for tectonic stability, slow ground-water movement, and long flow paths to the surface; (2) intensive subsurface exploration of such sites to determine the hydrologic and geologic conditions in and around the potential repository; (3) predictions of repository behavior based on the initial conditions and on various assumptions about the future; (4) evaluation of the risk associated with these predictions; and (5) a judgement whether these risks are acceptable. Some of the key earth-science questions involved in the first four steps are discussed. E.A.K.

N86-16781# Committee on Science and Technology (U. S. House).
THE INTERNATIONAL GEOSPHERE/BIOSPHERE PROGRAM,

1984
Washington GPO 1985 41 p refs Presented by the Subcommittee on Space Science and Applications to the Committee on Science and Technology, 99th Congress, 1st Session, Apr. 1985 (GPO-45-472) Avail: US Capitol, House Document Room

The present status of the International Geosphere/Biosphere Program (IGBP) is discussed. The IGBP will contribute to the understanding of the Earth as a system, and could deal with problems such as acid rain and the CO2 greenhouse effect. The IGBP will be an international and interdisciplinary study of the Earth as a system and the man induced and natural changes in that system. In the U.S. it will involve several Federal agencies and universities. E.A.K.

N86-16782# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
X-RAY MEASUREMENTS AT THE SOUTH ATLANTIC MAGNETIC ANOMALY
Osmar Pinto, Jr. and Walter D. Gonzalez Aug. 1985 30 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico Submitted for publication
(INPE-3603-PRE/794) Avail: NTIS HC A03/MF A01

Bremsstrahlung X-rays measured at Sao Jose dos Campos-Brazil on April 14 and December 18, 1981, with omnidirectional NaI (Tl) scintillation detectors on board stratospheric balloons, are discussed in the context of energetic electron precipitation at the South Atlantic Magnetic Anomaly (SAMA). During the event of April 14, 1981, an intensification in the X-ray flux was measured in association with a geomagnetically disturbed period. For the event of April 14, 1981, the integrated X-ray flux due to electron precipitation, in the energy interval of 30 to 150 keV, reached a value of -7.10-3 photon/sq cm/s/keV at -5 g/sq cm atmospheric depth. For the event of December 18, 1981, which occurred during a geomagnetically calm period, there was only an upper limit of 1/1000 photons/sq cm/s/keV, in the energy interval of 30 to 150 keV and at 5 g/sq cm., for any X-ray flux that was measured then, in association to electron precipitation. The measurements reported are compared to similar ones obtained in the past at the SAMA. E.A.K.

N86-16783# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THEORY OF THE ATMOSPHERIC SODIUM LAYER: A REVIEW
V. W. J. H. Kirchhoff Aug. 1985 46 p refs Presented at the 5th Symposium on Airglow and Auroral Excitations and Models, Prague, Czechoslovakia, 14-15 Aug. 1985; sponsored by International Association of Geomagnetism and Aeronomy Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-3605-PRE/796) Avail: NTIS HC A03/MF A01

The laser radar technique allows sodium densities and the sodium emissions to be monitored simultaneously. These results are described, keeping a balance between theory and experiment. Evolution of the photochemical theory, the model for diurnal variations, the sodium source, tidal effects, and problems at the top of the layer are addressed. E.A.K.

N86-16784# International Council of Scientific Unions, Urbana, Ill. Scientific Committee on Solar-Terrestrial Physics.
MIDDLE ATMOSPHERE PROGRAM. HANDBOOK FOR MAP. VOLUME 15: BALLOON TECHNIQUES
D. G. Murcray, ed. (Denver Univ., Colo.) Jun. 1985 156 p refs (Contract NASw-3805)
(NASA-CR-178440; NAS 1.26:178440; MAP-HANDBOOK-15) Avail: NTIS HC A08/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Some techniques employed by investigators using balloons to obtain data on the properties of the middle atmosphere are discussed. Much effort has gone into developing instruments which could be used on small balloons to measure temperature and variable species. These efforts are discussed. Remote sensing techniques used to obtain data on atmospheric composition are described. Measurement of stratospheric ions and stratospheric aerosols are also discussed. For individual titles, see N86-16785 through N86-16790.

N86-16785# Atmospheric Environment Service, Downsview (Ontario).
THE MEASUREMENT OF TEMPERATURE, OZONE AND WATER VAPOUR
T. McElroy *In* International Council of Scientific Unions Middle Atmosphere Program. Handbook for MAP, Volume 15 Jun. 1985 p 1-36 refs (For primary document see N86-16784 07-46)
Avail: NTIS HC A08/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Because of the importance of knowing temperature and humidity structure in the troposphere for the purpose of weather forecasting, temperature and humidity measurements as a function of pressure have been made for many decades. Recently, studies of the structure of the upper atmosphere have become of general interest. Many methods are employed to make measurements of three important atmospheric parameters. Some of these were developed through the use of the stratospheric research balloon, or high altitude sounding balloon. A sampling of these measurement techniques, such as the frost point hydrometer, an aluminum oxide humidity sensor, cryogenic sampling, ultraviolet fluorescence measurements, solar infrared absorption measurement by spectrometer, and infrared radiometry, are described in detail. E.R.

N86-16786# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MEASUREMENTS OF NEUTRAL CONSTITUENTS USING INFRARED AND VISIBLE REMOTE SENSING
N. Louisnard and S. Pollitt (National Physical Lab., Teddington, England) *In* International Council of Scientific Unions Middle Atmosphere Program. Handbook for MAP, Volume 15 Jun. 1985 p 37-70 refs (For primary document see N86-16784 07-46)
Avail: NTIS HC A08/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Remote sensing from balloon platforms by visible and infrared spectrometry has been extensively used for past 10 years to measure the concentration profiles of stratospheric species. A brief review of the instrumentation and method of analysis is made. Recent results concerning HCl, ClO, HF, NOx, HNO3, CO, CH4, H2O and O3 are presented. Author

N86-16787# Consiglio Nazionale delle Ricerche, Florence (Italy). Ist. di Recerca sulle Onde Elettromagnetiche.
MEASUREMENTS OF NEUTRAL CONSTITUENTS USING FAR INFRARED REMOTE SENSING TECHNIQUES
B. Carli and J. E. Harries (Rutherford Appleton Lab., Chilton, England) *In* International Council of Scientific Unions Middle Atmosphere Program. Handbook for MAP, Volume 15 Jun. 1985 p 71-89 refs (For primary document see N86-16784 07-46)
Avail: NTIS HC A08/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Since 1977 much progress has occured both in the direction of improvements in experimental measurement from balloons and in the area of theoretical studies of the far infrared spectrum. Recent experimental results of balloon measurements are discussed as is theoretical calculations and spectroscopic data of the far infrared spectrum. A dictorial representation of the far infrared spectrum of a selection of stratospheric constituents is presented and analyzed. E.R.

N86-16788*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MICROWAVE LIMB SOUNDER FOR STRATOSPHERIC MEASUREMENTS
J. W. Waters, J. C. Hardy, R. F. Jarnot, H. M. Pickett, and P. Zimmerman *In* International Council of Scientific Unions Middle

Atmosphere Program. Handbook for MAP, Volume 15 Jun. 1985 p 90-123 refs (For primary document see N86-16784 07-46)
Avail: NTIS HC A08/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The balloon-borne Microwave Limb Sounder (BMLS) measures atmospheric thermal emission from millimeter wavelength spectral lines to determine vertical profiles of stratospheric species. The instrument flown to data operates at 205 BHz to measure ClO, O3, and H2O2. A 63 GHz radiometer is added to test the technique for determining tangent point pressure from the MLS experiment on the Upper Atmosphere Research Satellite (UARS). Many additional species is also measured by the BLMS. A radiometer at 270 GHz would provide measurements of HO2, NO2, HNO3, N2O, 16O18O16O, and HCN. With this addition the BMLS can test the current theory of O3 heavy ozone photochemical balance in the upper stratosphere. Author

N86-16789# Institut d'Aeronomie Spatiale de Belgique, Brussels.
MEASUREMENT AND IDENTIFICATION OF STRATOSPHERIC IONS
D. Nevejans, J. Ingels, and E. Arijs *In* International Council of Scientific Unions Middle Atmosphere Program. Handbook for MAP, Volume 15 Jun. 1985 p 124-138 refs (For primary document see N86-16784 07-46)
Avail: NTIS HC A08/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Recent progress in the technology of stratospheric ion mass spectrometry is described. The state of the art as well as some typical measuring problems and needs for future developments are briefly reviewed. Author

N86-16790# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
MEASUREMENTS OF STRATOSPHERIC AEROSOLS
D. J. Hofman *In* International Council of Scientific Unions Middle Atmosphere Program. Handbook for MAP, Volume 15 Jun. 1985 p 139-153 refs (For primary document see N86-16784 07-46)
Avail: NTIS HC A08/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The history of measurements of the stratospheric aerosol layer is briefly reviewed. Balloon-borne measurements played a major role both in the discovery of the layer and in the susequent study of its nature. Following this introduction, stratospheric aerosol sources and balloon-borne measurement techniques are reviewed. Finally, the current status of this research area is outlined with data obtained mainly by balloon-borne techniques. It is concluded that a great deal has been learned in the past five years, due mainly to the increase of the occurrence of major volcanic eruptions, which are the predominant source of stratospheric particles, but also due to the development of instrumentation and techniques which have seen considerable application on the balloon platform. Author

N86-16791*# Massachusetts Inst. of Tech., Cambridge.
ZONALLY AVERAGED MODEL OF DYNAMICS, CHEMISTRY AND RADIATION FOR THE ATMOSPHERE Semiannual Status Report, 1 Jun. - 30 Nov. 1985
Ka Kit Tung [1985] 73 p refs
(Grant NAGw-798)
(NASA-CR-176465; NAS 1.26:176465) Avail: NTIS HC A04/MF A04 CSCL 04A

A nongeostrophic theory of zonally averaged circulation is formulated using the nonlinear primitive equations on a sphere, taking advantage of the more direct relationship between the mean meridional circulation and diabatic heating rate which is available in isentropic coordinates. Possible differences between results of nongeostrophic theory and the commonly used geostrophic formulation are discussed concerning: (1) the role of eddy forcing of the diabatic circulation, and (2) the nonlinear nearly inviscid limit vs the geostrophic limit. Problems associated with the traditional Rossby number scaling in quasi-geostrophic formulations are pointed out and an alternate, more general scaling based on the smallness of mean meridional to zonal velocities for a rotating planet is suggested. Such a scaling recovers the geostrophic balanced wind relationship for the mean zonal flow but reveals that the mean meridional velocity is in general ageostrophic. Author

N86-16792*# Alaska Univ., Fairbanks. Geophysical Inst.
AURORAL IMAGING FROM SPACELAB 3 Yearly Report
Thomas J. Hallinan and Don Lind Nov. 1985 9 p refs
(Grant NAG5-635)
(NASA-CR-178452; NAS 1.26:178452; YR-1) Avail: NTIS HC A02/MF A01 CSCL 04A

A comprehensive set of video and photographic images of the aurora was acquired and analyzed from Spacelab 3. Since each pass of Spacelab covers several hours of local time during an elapsed time of only a few minutes, it was hoped that these images would provide additional insight into the local-time dependence of the auroral morphology. Spacelab 3 was launched on April 29, 1985 and auroral data were obtained during the period April 30 to May 5. Preparations made for the auroral experiment, the quality and quantity of the data obtained, the initial scientific results, and ideas for further inquiry suggested by the preliminary review of the data are discussed. Author

N86-16793*# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.
DYNAMICS EXPLORER GUEST INVESTIGATOR Final Report, 1 Aug. 1984 - 31 Oct. 1985
J. J. Sojka 31 Oct. 1985 21 p refs
(Grant NAG5-455)
(NASA-CR-176477; NAS 1.26:176477) Avail: NTIS HC A02/MF A01 CSCL 04A

The use of Dynamics Explorer (DE) data sets to model the auroral inputs for the time dependent ionospheric model (TDIM) is reported. The modelling requires DE-1 SAI images and simultaneous DE-2 LAPI particle data. The data sets allow the large scale relative auroral variations and local absolute energy flexes and characteristics energies to be defined. The images enabled global scale auroral modelling with 12 min. time resolution and the LAPI data presented a detailed energy flux and characteristic energy calibration of the image model. The auroral model is used as an input to the TDIM and studies ionospheric storms. E.A.K.

N86-16794*# Missouri Univ., Rolla.
STUDY OF THE LITHOLOGY, PETROLOGY AND ROCK CHEMISTRY FOR THE PYRAMID MOUNTAINS, NEW MEXICO
Sheldon Kerry Grant [1985] 21 p
(Contract NAS13-251)
(NASA-CR-176473; NAS 1.26:176473) Avail: NTIS HC A02/MF A01 CSCL 08G

Rock and soil samples were collected at 24 sites within the Pyramid Mountains of southwestern New Mexico. The site locations are specified as 10-acre plots within the Section, Township, and Range land survey system. Hand specimen are described. The specimen were analyzed by X-ray fluorescence. The technique is designed to obtain good analysis for silica. The other elements are run so that matrix factor logic can be used to adjust the silica intensities, and to compensate for the element interaction. E.A.K.

N86-16795*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL AURORAL RESPONSES TO MAGNETOSPHERIC COMPRESSIONS BY SHOCKS IN THE SOLAR WIND: TWO CASE STUDIES
J. D. Craven (Iowa Univ., Iowa City), L. A. Frank (Iowa Univ., Iowa City), C. T. Russell (California Univ., Los Angeles), E. J. Smith (California Inst. of Technology, Pasadena), and R. P. Lepping Apr. 1985 31 p refs Submitted for publication Original contains color illustrations
(Contract NAS5-25689; Grants NAG5-483; NGL-16-001-002; Contract N00014-76-C-0016)

(NASA-CR-177835; NAS 1.26:177835; U-OF-IOWA-85-11) Avail: NTIS HC A03/MF A01 CSCL 04A

The global auroral responses to shocks in the solar wind at Earth were studied. The z-component of the interplanetary magnetic field, Bz, is negative ahead and behind the first shock and positive for the second case. A sudden-commencement geomagnetic storm develops in each case, with maximum D sub st < 190 nT. An immediate auroral response is detected at all longitudes around the auroral oval, in which auroral luminosities increase by a factor of 2 to 3 with the first samples after each sudden commencement. The time delay in obtaining the first sample varies with local time from approx. 1 to 18 mins. No other significant variations in the aurora are associated with the immediate response. Beginning approx. 30 mins after each sudden commencement, the aurora becomes active and displays significant variations in its luminosity and spatial distribution. For Bz < 0 an intense substorm develops. A sun-aligned transpolar arc forms when Bz > 0, appearing first at local midnight as a polar arc and then lengthening sunward from the auroral oval across the polar cap to noon at an average speed of approx. 1 km/sec. E.A.K.

N86-16796*# National Aeronautics and Space Administration, Washington, D.C.

PRESENT STATE OF KNOWLEDGE OF THE UPPER ATMOSPHERE: AN ASSESSMENT REPORT

Jan. 1984 73 p

(NASA-TM-87559; NAS 1.15:87559) Avail: NTIS HC A04/MF A01 CSCL 04A

A program of research, technology, and monitoring of the phenomena of the upper atmosphere, to provide for an understanding of and to maintain the chemical and physical integrity of the Earth's upper atmosphere was developed. NASA implemented a long-range upper atmospheric science program aimed at developing an organized, solid body of knowledge of upper atmospheric processes while providing, in the near term, assessments of potential effects of human activities on the atmosphere. The effects of chlorofluorocarbon (CFC) releases on stratospheric ozone were reported. Issues relating the current understanding of ozone predictions and trends and highlights recent and future anticipated developments that will improve our understanding of the system are summarized. E.A.K.

N86-16797# Physical Dynamics, Inc., Bellvue, Wash.

STUDIES OF GRAVITY WAVE PROPAGATION IN THE MIDDLE ATMOSPHERE Annual Report, 11 Feb. 1984 - 11 Feb. 1985

T. J. Dunkerton 25 Mar. 1985 24 p

(Contract F49620-83-C-0061)

(AD-A158726; PD-NW-85-330R; AFOSR-85-0505TR) Avail: NTIS HC A02/MF A01 CSCL 04/1

Research represents an effort to understand the role of gravity waves in the general circulation of the atmosphere. Such waves exist on a wide range of scales and frequencies. In this report, we describe ray tracing of gravity waves of horizontal scales from 50 to 800 km, all of which are observed in the middle atmosphere and play an essential role in the transport of momentum and mixing of constituents. Also presented are numerical simulations of gravity wave, mean-flow interaction, focusing on two aspects of this process: saturation and self-acceleration. Model results are compared to the predictions of a semi-analytic model of gravity waves. Finally, the report concludes with a discussion of constituent mixing in gravity wave breakdown, and problems in this area meriting further study. GRA

N86-16798# Naval Postgraduate School, Monterey, Calif.

METHODOLOGY FOR THE CONDUCT OF A SEISMIC RISK MITIGATION STUDY M.S. Thesis

M. D. Huntzinger Jun. 1985 136 p

(AD-A158958) Avail: NTIS HC A07/MF A01 CSCL 08/11

The author presents a methodology for evaluating the seismic vulnerability of a bases facilities. The methodology starts with the determination of the mission important facilities to a base, the foundation of which is the importance of the missions they house. The results of which are used to determine the facilities that should be studied for their seismic vulnerability under contracts administered by Naval Facilities Engineering Command, Engineering Field Divisions. The methodology presents alternatives for evaluating the results of the engineering and seismic studies, culminating in a rank ordering of the seismic upgrading projects developed by these studies. GRA

N86-16799# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

REVIEW OF METHODS FOR GENERATING SYNTHETIC SEISMOGRAMS

L. Peck Jun. 1985 48 p

(DA Proj. 4A1-61102-AT-24)

(AD-A159128; CRREL-85-10) Avail: NTIS HC A03/MF A01 CSCL 08/11

Various methods of generating synthetic seismograms are reviewed and examples of recent applications of the methods are cited. Body waves, surface waves, and normal modes are considered. The analytical methods reviewed include geometric ray theory, generalized ray theory (Cagniard-de Hoop method), asymptotic ray theory, reflectivity method, full wave theory, and hybrid methods combining ray theory and mode theory. Two numerical methods, those of finite differences and finite elements and a hybrid method containing finite differences with asymptotic ray theory are described. Limitations on the application or validity of the various methods stated. GRA

N86-16800# Science Applications International Corp., McLean, Va.

ACTIVE IONOSPHERIC GENERATION OF ELF/VLF WAVES Final Report

K. Papadopoulos, C. L. Chang, K. Ko, and C. Menyuk 15 Aug. 1985 96 p

(Contract N00014-84-C-0353)

(AD-A159359; AD-E700020; SAIC-85/1800) Avail: NTIS HC A05/MF A01 CSCL 04/1

During the past year our work supported by the ONR Contract N00014-84-C-0353 achieved many significant results concerning ionospheric generation of extremely low frequency/very low frequency (ELF/VLF) as well as ultra low frequency waves. A major breakthrough was our participation in an experiment using the Arecibo facility in which a preliminary proof of principle of two of the relevant concepts was produced. We highlight below some of our key results and refer the interested reader to the appendices for details. A novel process for generating ELF/ULF waves by using ionospheric heating was discovered and its applicability to auroral geometry was examined. The process relies on modulated E-region heating and does not depend on the presence of ambient ionospheric currents. GRA

N86-16801# Lawrence Livermore National Lab., Calif.

SIMPLIFIED SEISMIC PROBABILISTIC RISK ASSESSMENT: PROCEDURES AND LIMITATIONS

L. C. Shieh, J. J. Johnson, J. E. Wells, J. C. Chen, and P. D. Smith Aug. 1985 195 p

(TI85-016786; UCID-20468; NUREG/CR-4331) Avail: NTIS HC A09/MF A01

At the request of the U.S. Nuclear Regulatory Commission, the Lawrence Livermore National Laboratory developed a simplified seismic probabilistic risk assessment (PRA) methodology. The purpose of this methodology is to reduce the costs while adequately performing seismic probabilistic risk assessments of nuclear power plants. The development of the simplified seismic methodology is summarized and guidelines for applying the procedures are explained. The development effort is part of the scope of work of the Seismic Safety Margins Research Program (SSMRP). Development efforts included: the development of simplified methodology for estimating seismic response (including response correlation and random and modeling uncertainties) directly from free-field ground acceleration; the development of guidelines for event/fault trees to be used in simplified seismic PRAs; and analysis of the Zion Nuclear Power Plant, Zion, Illinois, using the simplified

methodology; and the issuance of a report giving procedure and guidelines for applying the simplified methodology. R.J.F.

N86-16802# Lawrence Livermore National Lab., Calif.
EARTHQUAKE SAFETY PROGRAM AT LAWRENCE LIVERMORE NATIONAL LABORATORY
G. E. Freeland Aug. 1985 11 p refs Presented at the DOE Natural Phenomena Hazards Mitigation Conference, Las Vegas, Nev., 7 Oct. 1985
(Contract W-7405-eng-48)
(DE85-017400; UCRL-93225; CONF-8510118-3) Avail: NTIS HC A02/MF A01

Within three minutes on the morning of January 24, 1980, an earthquake and three aftershocks, with Richter magnitudes of 5.8, 5.1, 4.0, and 4.2, respectively, struck the Livermore Valley. Two days later, a Richter magnitude 5.4 earthquake occurred, which had its epicenter about 4 miles northwest of the Lawrence Livermore National Laboratory (LLNL). Although no one at the Lab was seriously injured, these earthquakes caused considerable damage and disruption. Masonry and concrete structures cracked and broke trailers shifted and fell off their pedestals, office ceilings and overhead lighting fell, and bookcases overturned. Employee suddenly found themselves immersed in a site-wide program of repairing earthquake-damaged facilities, and protecting employees and the surrounding community from future earthquakes. Over the past five years, LLNL has spent approximately $10 million on its earthquake restoration effort for repairs and upgrades. The discussion there centers upon the earthquake damage that occurred, clean-up and restoration efforts, the seismic review of LLNL facilities, site-specific seismic design criteria, computer-floor upgrades, ceiling-system upgrades, unique building seismic upgrades, geologic and seismologic studies, and seismic instrumentation. GRA

N86-16803# Lawrence Livermore National Lab., Calif.
INTERPRETING GEOLOGICAL STRUCTURE USING KRIGING
N. Mao Jul. 1985 11 p refs Presented at the Society of Mining Engineers Fall Meeting, Albuquerque, N. Mex., 16 Oct. 1985
(Contract W-7405-eng-48)
(DE85-016439; UCRL-92423; CONF-851054-3) Avail: NTIS HC A02/MF A01

We applied kriging (geostatistics) to interpret the structure of basement rock in Yucca Flat, NTS from borehole data. The estimation error for 118 data is 81 m comparable with those based on both gravity and borehole data. Using digitized topographic data, we tested the kriging results and found that the model validation process (Thomas option) on data gave a fair representation of the overall uncertainty of the kriged values. DOE

N86-16804# Illinois State Geological Survey, Champaign. Dept. of Energy and Natural Resources.
STE. GENEVIEVE FAULT ZONE, MISSOURI AND ILLINOIS
W. John Nelson, Donald K. Lumm, and Howard R. Schwalb 1985 100 p
(TI85-901892; NUREG/CR-4333) Avail: NTIS HC A05/MF A01

The Ste. Genevieve Fault Zone crosses the northeast flank of the Ozark Dome in southeastern Missouri and extreme southern Illinois. The surface trace of faulting trends southeast and is approximately 120 miles (190 km) long. Major displacements are as much as 3,000 feet (900 m) downward to the northeast along a sharp monoclinal flexural, which is cut by one or more high-angle reverse faults. Smaller high-angle normal and reverse faults are found on both sides of the main zone. At both ends the Ste. Genevieve Fault Zone dies out into a monocline. Two periods of faulting occurred. The first was in late Middle Devonian time, and the second ran from latest Mississippian through early Pennsylvanian time, with possible minor post-Pennsylvanian movement. No displacements of Quaternary sediments have been detected, but small earthquakes occur from time to time along the Ste. Genevieve Fault Zone. Many faults in the zone appear capable of slipping under the current stress regime of east-northeast to west-southwest horizontal compression. It is concluded that the zone may continue to experience small earth movements, but catastrophic quakes similar to those at New Madrid in 1811 to 12 are unlikely. Author

N86-16805# Geological Survey, Menlo Park, Calif.
STRATIGRAPHY AND MAJOR ELEMENT GEOCHEMISTRY OF THE LASSEN VOLCANIC CENTER, CALIFORNIA
Michael A. Clynne 1984 203 p
(TI85-901785; USGS-OFR-84-224) Avail: NTIS HC A10/MF A01

Detailed geologic mapping of 200 sq km in and near Lassen Volcanic National Park, California and reconnaissance of the surrounding area, combined with reinterpretation of data in the literature, allow definition of the Lassen Volcanic Center and provide the stratigraphic framework necessary for interpretation of major-element chemical data. The Lassen Volcanic Center developed in three stages. Stages 1 and 2 produced Brokeoff Volcano, an andesitic composite cone that erupted mafic andesite to dacite 0.6 to 0.35 my ago. Volcanism then shifted in character and locale. Domes and flows of dacite and rhyodacite, and flows of hybrid andesite were erupted on the northern flank of Brokeoff Volcano during the period from 0.25 my ago to the present; these rocks comprise Stage 3 of the Lassen Volcanic Center. Rocks of the Lassen Volcanic Center are typical of subduction-related calc-alkaline volcanic rocks emplaced on a continental margin overlying sialic crust. Porphyritic andesite and dacite with high Al_2O_3, low TiO_2, medium K_2O, and FeO/MgO 1.5 to 2.0 are the most abundant rock types. DOE

N86-16806# Lawrence Livermore National Lab., Calif.
CALCULATION OF GRAVIMETRIC DENSITY CAUSED BY THREE-DIMENSIONAL STRUCTURE
J. R. Hearst, R. E. Carlson, and S. R. Clark Aug. 1985 27 p refs Presented at the 3rd Symposium on Containment of Underground Nuclear Explosions, Idaho Falls, Idaho, 10 Sep. 1985 Prepared in cooperation with EG and G, Inc., San Ramon, Calif.
(Contract W-7405-eng-48)
(DE85-018018; UCRL-92268; CONF-850953-6) Avail: NTIS HC A03/MF A01

The difficulty with calculating the gravitational effect of three-dimensional structure is not in the calculation itself, but in the description of the structure such that it fills all space and does not contain voids. We have solved this problem by using contour maps of subsurface boundaries between media of different density. The contour lines are digitized, and the digitized data are used to construct a function that is then evaluated over a fine grid surrounding the borehole. The algorithm used to construct the approximating function is a modification of Hardy's multiquadric method for interpolating scattered data. The edges of the grid are smoothed, and then extended to distances great enough to be effectively infinite in the gravity calculation. The gravity calculation uses an algorithm by Banerjee and Gupta for the calculation of the gravitational effect of a right rectangular prism. For each rectangle of the grid, the depth of the corners is averaged and used for the depth of one end of the prism. At each grid rectangle there are two prisms: one with the top at the top surface and the bottom at the contact surface, the other with the top at the contact surface and the bottom at the bottom surface. Two contact surfaces (describing three layers) can be used, in which case a third prism, with its ends on the two contact surfaces, is calculated. Gravimetric density is then calculated from the vertical gradient of gravity. DOE

N86-16807# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (West Germany). Inst. fuer Atmosphaerische Umweltforschung.
BALANCE OF THE TROPOSPHERIC OZONE AND ITS RELATION TO STRATOSPHERIC INTRUSIONS INDICATED BY COSMOGENIC RADIONUCLIDES Final Technical Report, 1 Nov. 1977 - 31 Jan. 1984
R. Reiter, H. J. Kanter, H. Jaeger, and K. Munzert 1985 22 p
(Contract DE-AC02-76EV-03425)
(DE86-000213; DOE/ET-03425/28-Pt-14) Avail: NTIS HC A02/MF A01

The objective was to clarify the effect of stratospheric intrusions on the tropospheric ozone budget. The correlation between stratospheric-tropospheric exchange and solar events was also investigated. Tropospheric ozone was recorded at three different levels. The radioisotopes (7)Be and radon daughter products (214)Pb and (214)Bi were used as tracers to identify the source of ozone. DOE

N86-16808# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
GODHAVN GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1978 Progress Report
Nov. 1984 67 p refs
(ISBN-87-7478-242-8) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the Godhavn magnetic laboratory during 1978 are presented. The measurements show hourly means and ranges. Annual mean values since 1926 are given. Author (ESA)

N86-16809# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
GODHAVN GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1981 Progress Report
Nov. 1984 67 p refs
(ISBN-87-7478-245-2) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the Godhavn magnetic laboratory during 1981 are presented. The measurements show hourly means and ranges. Annual mean values since 1926 are given. Author (ESA)

N86-16810# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
GODHAVN GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1983 Progress Report
Nov. 1984 70 p refs
(ISBN-87-7478-240-1) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the Godhavn magnetic laboratory during 1983 are presented. The measurements show hourly means and ranges. Annual mean values since 1926 are given. Author (ESA)

N86-16811# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
NARSSARSSUAQ GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1983 Progress Report
Jan. 1985 67 p refs
(ISBN-87-7478-250-9) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the Narssarssuaq magnetic laboratory during 1983 are presented. The measurements show hourly means and ranges. Annual mean values for 1983 are given. Author (ESA)

N86-16812# Stockholm Univ. (Sweden). Arrhenius Lab.
ON THE PARAMETERIZATION OF SUBGRID SCALE OROGRAPHIC EFFECTS IN MODELS OF THE LARGE SCALE ATMOSPHERIC FLOW
Aake Johansson 24 Apr. 1985 52 p refs
(DM-44; ISSN-0349-0467) Avail: NTIS HC A04/MF A01

A parameterization scheme for handling the effects of subgrid scale orography, based on a linear model of the stationary, internal gravity wave field forced by orography is presented. Orographic features which influence the orographic forcing function in the model are discussed. A detailed data set of the topography is needed to produce the proper orographic forcing function. A test under realistic conditions was undertaken to evaluate the quantitative effects of the scheme. The results indicate that the scheme produces mean flow tendencies which are very much a function of the vertical structure of the atmosphere, showing that the scheme is very flow dependent. Time and space scales, and problems which may arise in the tropics are considered. Author (ESA)

N86-16813# Stockholm Univ. (Sweden). Arrhenius Lab.
A LOW-ORDER MODEL FOR MOIST CONVECTION
Xiang-yu Huang Jun. 1985 55 p refs
(DM-45; ISSN-0349-0467) Avail: NTIS HC A04/MF A01

A low-order model for two-dimensional atmospheric moisture convection is developed. Four components are chosen to represent the motion and temperature deviation fields. Condensation is introduced by using a simplified scheme and only the condensation heating is considered. Results from stability studies of the model show that the hysteresis effect from condensation can be observed. Author (ESA)

N86-16814# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
BRORFELDE GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1981 Progress Report
1985 35 p refs
(ISBN-87-7478-251-7) Avail: NTIS HC A03/MF A01

The results of the standard observations carried out at the Brorfelde magnetic laboratory during 1981 are presented. The measurements show hourly means and mean diurnal inequalities. Author (ESA)

N86-16815# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
BRORFELDE GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1982 Progress Report
1985 56 p refs
(ISBN-87-7478-252-5) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the Brorfelde magnetic laboratory during 1982 are presented. The measurements show hourly means and diurnal variations. Author (ESA)

N86-16816# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
ATMOSPHERIC INFRARED BACKSCATTERING PROFILES: INTERPRETATION OF STATISTICAL AND TEMPORAL PROPERTIES
M. J. Post May 1985 113 p
(PB85-212934; NOAA-TM-ERL-WPL-122) Avail: NTIS HC A06/MF A01 CSCL 04A

The design, implementation, and calibration of NOAA's coherent, pulsed, Doppler lidar is described. This lidar was used to acquire 252 high-quality, independent measurements of atmospheric backscattering profiles from 4 to 80 km altitude over Boulder, Colorado, at a wavelength of 10.6 micrometers between May 1981 and May 1983, a period that includes the injection and removal of debris from the El Chichon eruptions. GRA

N86-16817# Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
DEVELOPMENT OF AN ATMOSPHERIC DISPERSION MODEL FOR HEAVIER-THAN-AIR-GAS MIXTURES, VOLUME 1 Final Report, Sep. 1980 - Feb. 1985
J. A. Havens and T. O. Spicer Feb. 1985 188 p
(Contract DTCG23-80-C-20029)
(PB85-228633; GRI-85/0133) Avail: NTIS HC A09/MF A01 CSCL 04A

The mathematical modeling techniques which have been used to predict atmospheric dispersion of heavy gases are reviewed and critiqued. These dispersion processes are characterized by three regimes or phases: near-field, negative buoyancy-dominated flow regime, intermediate-field, stably stratified shear flow regime, and far-field, passive turbulent diffusion regime. Mathematical models of laboratory and natural gravity currents are used to describe the negative buoyancy-dominated regime flow and dilution processes. The model concepts are consistent with the limiting passive behavior of demonstrated air pollution models. An interactive computer model for heavy gas dispersion (DEGADIS) is developed. Author (GRA)

N86-16818# Illinois State Geological Survey, Champaign.
DEPOSITIONAL ENVIRONMENTS AND CORRELATION PROBLEMS OF THE WEDRON FORMATION (WISCONSINAN)

IN NORTHEASTERN ILLINOIS: GUIDEBOOK
W. H. Johnson, B. J. Socha, A. K. Hansel, L. R. Follmer, and J. M. Masters 1985 98 p Prepared in cooperation with Illinois Univ., Urbana-Champaign
(PB85-210581; IL/SGS/GB-16) Avail: NTIS HC A05/MF A01 CSCL 08G

Glacial deposits and landforms in northeastern Illinois and investigations in this area have been central to the development of concepts of the Wisconsian glaciation. Various aspects of glacial depositional environments and stratigraphic and correlation problems of the Wedron Formation are discussed. The Wedron Formation, includes till and intercalated gravel, sand, and silt of the Woodfordian Substage (late Wisconsinan). It comprises the succession of Woodfordian deposits that extend upward from the basal contact with Morton Loess to the top of till below the Two Creeks deposit at Two Creeks, Wisconsin. GRA

N86-16819# Illinois State Geological Survey, Champaign.
SILURIAN GEOLOGY OF THE DES PLAINES RIVER VALLEY, NORTHEASTERN ILLINOIS
D. G. Mikulic, M. L. Sargent, R. D. Norby, and D. R. Kolata 1985 64 p
(PB85-210060; IL/SGS/GB-17) Avail: NTIS HC A04/MF A01 CSCL 08G

Silurian dolomites are among the most poorly understood rock units in the midwestern United States. These rocks have not attracted as much interest as those in other Paleozoic systems for several reasons. Destruction of primary fabric by dolomitization discourages sedimentological studies, carbonate buildups complicate local correlations. However, the development of large, deep quarries has advanced the understanding of the lithostratigraphy of Silurian rocks, particularly in northeastern Illinois, where the growth of the Chicago area has supported a large stone industry for the last 150 years. This field trip provides a good overview of Chicago-area Silurian geology. Author (GRA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-16820# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
THE 1985 ATLANTIC SEASONAL TROPICAL CYCLONE ACTIVITY AND VERIFICATION OF AUTHOR'S FORECAST
William M. Gray 25 Nov. 1985 8 p refs
Avail: NTIS HC A02/MF A01

This paper gives a brief summary of the tropical cyclone activity which occurred in the Atlantic in 1985 and verifies the author's (Gray, 1985a, 1985b) forecast of this activity that was issued on 28 May and updated on 27 July. This forecast was based on the author's previous research (Gray, 1983, 1984a, 1984b) which relates seasonal Atlantic hurricane activity to: (1) the El Nino (EN); (2) the Quasi-Biennial Oscillation (QBO) of equatorial 30 mb stratospheric wind; (3) the April to May and June to July Caribbean Basin-Gulf of Mexico Sea-Level Pressure Anomaly (SLPA), and (4) lower latitude Caribbean Basin 200 mb zonal wind anomaly. Information received by the author as of 28 May 1985 indicated that the 1985 hurricane season should have been an above average year with about 8 hurricanes (6 is average), 11 hurricanes and tropical storms (9 is average), and 35 hurricane days (25 is average). This forecast was updated on 27 July 1985 to the revised values of 7 hurricanes, 10 hurricanes and tropical storms and thirty hurricane days. The actual number of hurricanes which occurred in 1985 was 7 (1 above average); actual number of hurricanes and tropical storms was 11 (2 above average); and actual number of hurricane days was 29 (4 above average). Author

N86-16821# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DIURNALLY FORCED TROPICAL TROPOSPHERIC CIRCULATION OVER SOUTH AMERICA
Pedro LeitedaSilvaDias, Jose Paulo Bonatti, and Vernon Edgard Kousky Jun. 1985 43 p refs Submitted for publication
(INPE-3566-PRE/771) Avail: NTIS HC A03/MF A01

The impact of diurnally varying thermal forcing on the tropical circulation is studied with a linearized shallow water model on an equatorial beta plane. The mass and flow fields are interpreted as internal modes of a stratified model, based on the results of the projection of typical cumulus heating profiles. The projection of referred profiles is optimally described by a convergence/divergence pattern at high/low levels in the tropics with an equivalent depth on the order of 220 m. The effect of altering the size, latitude and internal mode representation of a bell shaped mass source is considered in terms of the energy partition between Kelvin, mixed Rossby-gravity and gravity intertial waves and Rossby waves. The 500 mb vertical motion fields associated with the diurnal evolution of the oscillatory solution are compared to those derived from the National Meteorological Center final Analysis over the tropical South America. Author

N86-16822# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PYRANOMETER COMPARISON AT INPE, ATIBAIA, IN AUGUST 1983
Jorgdieter Anhalt Jun. 1985 13 p refs
(INPE-3561-NTE/236) Avail: NTIS HC A02/MF A01

Pyranometers and Pyroheliometers are used for collecting meteorological data or solar collector tests. The calibration constants of these instruments vary with time and have to be recalibrated in certain intervals. The recalibration of four pyranometers and one pyrheliometer under tropic climate conditions using secondary standard instruments, and calibration standards together with data acquisition system are discussed. The results obtained can not be explained by the aging of these instruments. E.A.K.

N86-16823*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEVERE STORMS BRANCH RESEARCH REPORT (APRIL 1984 APRIL 1985)
L. Dubach, ed. 1985 146 p
(NASA-TM-86238; Rept-86B0028; NAS 1.15:86238) Avail: NTIS HC A07/MF A01 CSCL 04B

The Mesoscale Atmospheric Processes Research Program is a program of integrated studies which are to achieve an improved understanding of the basic behavior of the atmosphere through the use of remotely sensed data and space technology. The program consist of four elements: (1) special observations and analysis of mesoscale systems; (20 the development of quanitative algorithms to use remotely sensed observations; (3) the development of new observing systems; and (4) numerical modeling. The Severe Storms Branch objectives are the improvement of the understanding, diagnosis, and prediction of a wide range of atmospheric storms, which includes severe thunderstorms, tornadoes, flash floods, tropical cyclones, and winter snowstorms. The research often shed light upon various aspects of local weather, such as fog, sea breezes, air pollution, showers, and other products of nonsevere cumulus cloud clusters. The part of the program devoted to boundary layer processes, gust front interactions, and soil moisture detection from satellites gives insights into storm growth and behavior. E.A.K.

N86-16824*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOIL TEMPERATURE EXTREMA RECOVERY RATES AFTER PRECIPITATION COOLING
Jean E. Welker Oct. 1984 22 p refs
(NASA-TM-86163; NAS 1.15:86163) Avail: NTIS HC A02/MF A01 CSCL 04B

From a one dimensional view of temperature alone variations at the Earth's surface manifest themselves in two cyclic patterns of diurnal and annual periods, due principally to the effects of diurnal and seasonal changes in solar heating as well as gains and losses of available moisture. Beside these two well known

cyclic patterns, a third cycle has been identified which occurs in values of diurnal maxima and minima soil temperature extrema at 10 cm depth usually over a mesoscale period of roughly 3 to 14 days. This mesoscale period cycle starts with precipitation cooling of soil and is followed by a power curve temperature recovery. The temperature recovery clearly depends on solar heating of the soil with an increased soil moisture content from precipitation combined with evaporation cooling at soil temperatures lowered by precipitation cooling, but is quite regular and universal for vastly different geographical locations, and soil types and structures. The regularity of the power curve recovery allows a predictive model approach over the recovery period. Multivariable linear regression models alloy predictions of both the power of the temperature recovery curve as well as the total temperature recovery amplitude of the mesoscale temperature recovery, from data available one day after the temperature recovery begins.

Author

N86-16825*# Engineering Analysis, Inc., Huntsville, Ala.

ATMOSPHERIC PHENOMENA DATA PROCESSING AND DISPLAY

Frank B. Tatom and Lynn R. Purser 30 Jul. 1985 22 p refs

(Contract NAS8-35979)

(NASA-CR-178448; NAS 1.26:178448; EAI-TR-85-004A) Avail: NTIS HC A02/MF A01 CSCL 04B

Several related efforts which deal with the analysis and display of data pertaining to various atmospheric phenomena are reported. Spectrometer data analysis, with refinements to the preexisting programs, is discussed. A discussion of a Monte Carlo simulation of a photon transfer problem is presented. Raw data gathered in the field by a high-flying U2 aircraft is usually pulse code modulated (PCM). Techniques to reduce the data into a computer-amenable format are described. Several utility programs and other work are outlined. E.A.K.

N86-16826# Naval Postgraduate School, Monterey, Calif.

AN OBJECTIVE DETERMINATION OF TROPICAL CYCLONE WARNING POSITION M.S. Thesis

W. T. Curry Jun. 1985 59 p

(AD-A159390) Avail: NTIS HC A04/MF A01 CSCL 04/2

A technique has been developed to determine objectively the location of a tropical cyclone at warning time and reduce the short-term forecast errors due to errors in the warning position. The western North Pacific CLIPER (CLImatology and PEPsistence) forecast scheme is used to generate a potential track from each fix, and a smooth curve is fit to the future and past positions. When multiple fixes are available, weighting functions are applied to account for fix platform accuracy and time of receipt. A set of 836 cases from 30 storms during 1981 to 1983 was evaluated. Using the objective scheme, 16 of the 30 tropical cyclones had reduced warning position errors compared to the Joint Typhoon Warning Center official warning position. For 11 of the 30 storms, the objective warning positions resulted in more accurate 24-h forecasts with the CLIPER technique than the official warning positions. This technique appears to provide an efficient, interactive tool to the forecaster to use in establishing the warning position.

GRA

N86-16827# Naval Environmental Prediction Research Facility, Monterey, Calif.

AN APPLICATION OF DISCRIMINANT ANALYSIS TO A TROPICAL CYCLONE INTENSIFICATION FORECASTING ALGORITHM Final Report, Aug. 1984 - Jul. 1985

B. J. Cook Jul. 1985 40 p

(NR Proj. F59-551)

(AD-A159399; NEPRF-TR-85-02) Avail: NTIS HC A03/MF A01 CSCL 04/2

A stepwise screening discriminant analysis is used to develop an algorithm for forecasting tropical cyclone intensification. Some potential predictors used in the analysis are derived from FNOC (Fleet Numerical Oceanography Center) zonal wind analyses. Other potential predictors considered are simple climatological parameters and persistence of intensification. The potential predictors are screened by a stepwise discriminant analysis program to determine which significantly discriminate between three (intensifying, filling, and neither) intensification categories. The best discriminators are then used as predictors in an intensification forecasting algorithm. The algorithm is developed and tested on Western Pacific tropical cyclone data from the years 1974 to 1982. In addition to the independent test, stability of the algorithm is investigated and a test is conducted to compare forecasts produced by the algorithm with forecasts made by JTWC (Joint Typhoon Warning Center) and with forecasts of persistence of intensification. The algorithm shows skill relative to persistence and compares favorably with the official forecasts, although most of the differences between the scores are not significant. For this data set, JTWC did not forecast tropical cyclone intensification significantly better than the derived algorithm or persistence. Author (GRA)

N86-16828# Massachusetts Univ., Amherst.

GRID POINT SURFACE AIR TEMPERATURE DATA SET FOR THE NORTHERN HEMISPHERE

P. D. Jones, S. C. B. Raper, B. Santer, B. S. G. Cherry, C. Goodess, P. M. Kelly, T. M. L. Wigley, R. S. Bradley, and H. F. Diaz Jul. 1985 256 p refs Prepared in cooperation with National Oceanic and Atmospheric Administration, Boulder, Colo. and East Anglia Univ. Norwich, England

(Contracts DE-AC02-81EV-10739; DE-AC02-79EV-10098)

(DE85-015609; DOE/EV-10098/2) Avail: NTIS HC A12/MF A01

A compilation of 2666 station records of monthly surface air temperature has been assembled for the Northern Hemisphere. In order to use these data to form a gridded data set for the Northern Hemisphere we have assessed, where possible, the homogeneity of each of these records. The results of this assessment are presented and stations are classed as immediately usable, corrected or uncorrectable. Full details of how this has been achieved for each station are presented in tabular form. Of the 2666 station records, 1584 were used to produce the gridded temperature data set. Temperature anomalies were calculated with respect to the appropriate monthly mean for the reference period 1951 to 1970 using the homogenized data. Anomalies at each point of a 5 deg latitude by 10 (deg) longitude grid were interpolated from the station data for each month for the period 1951 to 1984. DOE

N86-16829# Lawrence Livermore National Lab., Calif.

TOWARD QUANTIFYING THE SOURCE TERM FOR PREDICTING GLOBAL CLIMATIC EFFECTS OF NUCLEAR WAR: APPLICATIONS OF URBAN FIRE CODES

T. A. Reitter, S.-W. Kang, and A. N. Takata 15 Jun. 1985 94 p refs

(DE85-017456; UCRL-53647) Avail: NTIS HC A05/MF A01

Calculating urban area fire development is critical to estimating global smoke production effects due to nuclear warfare. To improve calculations of fire starts and spread in urban areas, we performed a parameter sensitivity analysis using three codes. We applied improved versions of the codes to two urban areas: an infinite uniform city with only one type of building and the San Jose urban area. We varied parameters and compared affected fuel consumption and areas with a baseline case. The dominant parameters for the uniform city were wind speed, atmospheric visibility, frequency of secondary fire starts, building density, and window sizes. For San Jose, they were wind speed, building densities, location of ground zero, height of burst, window sizes, and brand range. Because some results are very sensitive to actual fuel distribution characteristics and the attack scenario, it is now possible to use a uniform city to represent actual urban areas. This was confirmed by a few calculations for the Detroit area as of the late 1960s. Many improvements are needed, such as inclusion of fire induced winds and debris fires, before results can be extrapolated to the global scale. DOE

N86-16830# Brookhaven National Lab., Upton, N. Y.

CHEMICAL CONVERSIONS IN CLOUDS

S. E. Schwartz Jul. 1985 95 p refs Presented at the 2nd US-Dutch International Symposium on Aerosols, Williamsburg, Va.,

19 May 1985
(Contract DE-AC02-76CH-00016)
(DE86-000033; BNL-36923; CONF-8505106-1) Avail: NTIS HC A05/MF A01

Clouds constitute an extreme atmospheric aerosol in terms of particle size and condensed-phase mass. The large amount of liquid water in clouds as well as the high state of dispersion make clouds a potentially important medium for atmospheric reactions, depending upon thermochemical driving force and chemical kinetics of particular reactions. This paper presents the formalism for evaluating the rates of in-cloud reactions making use of laboratory-determined physical-chemical properties and assumed or measured reagent concentrations and other situational variables. Accurate description of these rates is sensitive to the mass-accommodation coefficient (ALPHA) (fraction of gas kinetic collisions at the air-water interface effective in transfering gaseous species to cloud droplets) if (ALPHA) < 0.01. Little information pertinent to (ALPHA) is available for relevant solute gases. Attention is directed to reaction of SO2 and NO2 to form sulfuric and nitric acids, respectively, and to reactions involving oxidants (O3, H2O2) and free radicals (HO, HO2). Important in-cloud reactions identified include aqueous-phase oxidation of SO2 by H2O2 and O3 and gas-phase oxidation of NO2 by O3 followed by uptake of N2O5 or NO3 by cloudwater. DOE

N86-16831# Institute of Oceanographic Sciences, Wormley (England).
REPORT ON SEA LEVEL DATA COLLECTED DURING THE MEDALPEX EXPERIMENT FROM SEPTEMBER 1981 - SEPTEMBER 1982
L. J. Rickards 1985 174 p refs
(IOS-209) Avail: NTIS HC A08/MF A01

The Mediterranean Alpine Experiment (MEDALPEX) was undertaken to investigate the role of atmospheric forcing on the dynamics of the Western Mediterranean. Hourly values of sea level are collected from 29 sites for a 1 yr period. The data are tidally analyzed and low pass filtered, and nontidal fluctuations are investigated using principal component analysis. The low pass filtered data show a fairly good correlation with the passage of meteorological events, particularly the Adriatic Sea data. Principal components analysis suggests that the nontidal variations in sea level in the Western Mediterranean and the Adriatic Sea are decoupled over the period of MEDALPEX. A magnetic tape copy of the data set, including documentation, is available.
Author (ESA)

N86-16832# Royal Netherlands Meteorological Inst., De Bilt. Klimatologische Dienst.
HOW EXTREME WAS THE WEATHER AGAIN [HOE EXTREEM WAS HET WEER OOK WEER]
A. Denkema Apr. 1985 39 p In DUTCH
(KNMI-168; B8568884) Avail: NTIS HC A03/MF A01

Extreme values of weather data in the Netherlands since 1849 are listed. The data obtained at the weather station De Bilt concerning temperature, precipitation, and sunshine were used.
Author (ESA)

N86-16833# Royal Netherlands Meteorological Inst., De Bilt. Afdel. Fysische Meteorologie.
MESOGERS 1984, THE DATA SET OF STATION C8
A. C. M. Beljaars, W. A. A. Monna, and J. G. vanderVliet 1985 51 p refs
(KNMI-TR-68; ISSN-0169-1708; B8568882) Avail: NTIS HC A04/MF A01

Boundary layer characteristics over nonhomogeneous terrain in the Gers region of France were studied. Synoptic observations of wind speed and direction, dry bulb temperature, and dew point temperature; energy balance at 11m height (20 min averages); and doppler sodar data (20 min averages of horizontal wind, echo intensity, and standard deviation of the vertical wind component as a function of height recorded continuously) are presented. Odeh-Tadjbakhsh's conjecture is discussed.
Author (ESA)

N86-16834# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Dynamische Meteorologie.
THE AIR MASS TRANSFORMATION (AMT) MODEL: WINTER EXPERIMENTS [HET AMT-MODEL: WINTEREXPERIMENTEN]
R. C. vandenBerg and J. Reiff 1985 55 p refs In DUTCH; ENGLISH summary
(KNMI-TR-69; B8568883; ISSN-0169-1708) Avail: NTIS HC A04/MF A01

Experiments with the AMT model were performed in order to improve the model. The original model, which can describe the evolution of the atmospheric boundary layer is presented. It is obvious that the model's sensitivity to the choice of wind field is considerable. For the transition from a stable to an unstable boundary layer, a criterion based on the ratio of buoyancy to mechanical turbulence is introduced; it appears to be difficult to ascertain a precise value of this ratio. A comparison of 33 model temperature profiles with observed profiles indicates that processes can cause difficulties in the model with respect to the evaporation problem in a frost period without snow cover, the AMT results are slightly better for a reduced evaporation rate. Suggestions for improving the model are made. Author (ESA)

N86-16835# Royal Netherlands Meteorological Inst., De Bilt. Klimatologische Dienst.
STATISTICAL TESTS ON THE HOMOGENEITY OF SERIES OF SUNSHINE DURATION IN THE NETHERLANDS IN THE PERIOD 1951 - 1980
A. Denkema 1985 17 p refs In DUTCH; ENGLISH summary
(KNMI-TR-70; B8569402; ISSN-0169-1708) Avail: NTIS HC A02/MF A01

Homogeneity tests were applied to series of yearly sunshine duration measured at 35 stations in the Netherlands, in the period 1951 to 1980. Three methods for testing the homogeneity of series are treated: the von Neumann quotient, the maxima and minima of partial sums, and the Worsley test. Although the series of 13 stations shows evidence of nonhomogeneity, the magnitude proves to be too small to have an influence in practical applications. Author (ESA)

N86-16836# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Dynamische Meteorologie.
THE TEMPERATURE INVERSION OF THE NOCTURNAL BOUNDARY LAYER. A TEST OF SEVERAL TYPES OF PARAMETERIZATION [DE TEMPERATUURINVERSIE VAN DE NACHTELIJKE GRENSLAAG: EEN TEST VAN VERSCHILLENDE TYPEN PARAMETERISATIES]
A. vanPul and J. Reiff 1985 82 p refs In DUTCH; ENGLISH summary
(KNMI-TR-71; B8569403; ISSN-0169-1708) Avail: NTIS HC A05/MF A01

The temperature structure of the nocturnal boundary layer (NBL) and its height were investigated. The approach of Stull, which provides a sensible heat flux history length scale (H) based on the nocturnal heat flux is tested; H seems to be sufficient to define a common similarity shape for the potential temperature profile. This profile is tested for temperature profiles of a data set of 25 heights, at 3 different times. The exponential profile as well as the cubic profile proposed by Yamada give a good fit. A weak correlation between the inversion heights at two stations is determined. For the entire data set the correlation between the observed H and the estimated H, parameterized by Stull is weak, except for clear nights. Tests show that the Stull parameterization method of H does not work for early hours in the evening. It cannot be proven if Stull's proposed parameterization of the NBL evolution is better or worse than other parameterization schemes due to a lack of data. Author (ESA)

N86-16837# Royal Netherlands Meteorological Inst., De Bilt. Centrale Weerdienst.
THE AGRICULTURAL WEATHER REPORT FOR THE YSSELMEER POLDERS NETHERLANDS IN 1983 AND 1984: REPORT OF A PROJECT [HET LANDBOUWWEEBERICHT VOOR DE IJSSELMEERPOLDERS IN 1983 EN 1984: VERSLAG

VAN EEN PROJECT]
E. Schreuder 1985 24 p refs In DUTCH
(KNMI-TR-72; B8569404; ISSN-0169-1708) Avail: NTIS HC A02/MF A01

The special weather report for the agriculture in the Ysselmeer polders is presented. This telephonic weather report for a limited and sharply determined area is described. The way in which the farmers used the information, and their generally positive judgment are outlined. The farmers were mainly interested in detailed precipitation and wind forecasts. A separate verification report shows that more detailed precipitation, wind, and sunshine forecasts are only meaningful and reliable for the first 6 hours.
Author (ESA)

N86-16838# National Weather Service, Garden City, N.Y.
MDR: PROCESSING MANUALLY DIGITIZED RADAR OBSERVATIONS, REVISED
M. R. Peroutka Jun. 1985 56 p
(PB85-220580; NOAA-NWS-ERCP-15-Rev) Avail: NTIS HC A04/MF A01 CSCL 04B

Manually digitized radar (MDR) reads 7 hours of radar observations from the local data base and produces three graphics. The graphics are one, three and six hourly sums of MDR values or rainfall amounts. Convective and stratiform Z-r relations are provided along with the option for a user-defined relation. A program which can cull the digitized data from a number of radar observations and then put them into a usable form is described. GRA

N86-16839# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
INFERENCE OF FRONTAL TEMPERATURE CHANGE FROM THE OBSERVED WIND FIELD
D. W. VandeKamp May 1985 27 p
(PB85-221240; NOAA-TM-ERL-WPL-124) Avail: NTIS HC A03/MF A01 CSCL 04B

Assuming steady state and neglecting viscosity, the equations balancing the inertial, and buoyancy terms in the equations of motion can be used to provide a relationship between the wind and temperature discontinuities in the atmosphere. If it is specified that the dynamic boundary condition be satisfied across a frontal discontinuity, a relationship between the slope and the magnitudes of the discontinuities is obtained known as the Margules Equation. The adequacy of the relationship for quantitatively inferring the magnitude of front-related temperature inversions from the wind field discontinuity and its temporal slope provided by the radar wind profilers is examined. GRA

N86-16840# National Weather Service, Garden City, N.Y.
TIMCHEK
G. G. Rigdon Jun. 1985 34 p
(PB85-221257; NOAA-WS-ERCP-33) Avail: NTIS HC A03/MF A01 CSCL 04B

The program which checks the AFOS data program base to see if new data are in and if it will run a program for the Weather Service forecasting office the program can also be used to find out if the program has already been run, in which case it will not run the program again. The procedure is used to run various applications such as upper air plots, mesoanalysis programs, raob plots, surface plots, FT monitor program, NWWS roundup programs, the national verification programs, etc. The program allows the checking of the database at different times for new data. GRA

N86-16841# National Center for Atmospheric Research, Boulder, Colo.
CONVERSATIONS WITH BERNHARD HAURWITZ
G. W. Platzman Jun. 1985 192 p Sponsored in part by NSF, Washington, D.C. Prepared in cooperation with Chicago Univ., Ill.
(PB85-223063; NCAR/TN-257+PROC) Avail: NTIS HC A09/MF A01 CSCL 04B

Interviews with Bernhand Haurwitz are presented. The purpose is to give a technical perspective on Bernhard Haurwitz's scientific work, as viewed by him in retrospect. GRA

N86-16842# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR MID-JULY TO MID-AUGUST 1985, VOLUME 39, NUMBER 14, JULY 13, 1985
13 Jul. 1985 9 p
(PB85-230258) Avail: NTIS HC A02/MF A01 CSCL 04B

The precipitation and temperature weather outlook for periodic and seasonal variations for North America is given. Data is given in tabular form and is accompanied by meteorological charts. GRA

N86-16843# National Weather Service, Silver Spring, Md. Techniques Development Lab.
AFOS (AUTOMATION OF FIELD OPERATIONS AND SERVICES) MONITORY OF TERMINAL FORECASTS
D. J. Vercelli and G. A. Norman May 1985 33 p
(PB85-236388; NOAA-NWS-TDL-CP-85-1) Avail: NTIS HC A03/MF A01 CSCL 04B

Aviation terminal forecasts (FT's) are issued three or four times per day, depending on location, for selected terminals within the area of responsibility of a Weather Service Forecast Office (WSFO). The FT's contain specific meteorological information on cloud heights and amount, visibility, weather, obstructions to vision, and wind. This information is considered to be the most important to aviation interest in and near the terminal area. A FORmula TRANslation (FORTRAN) program, described by this document, will assist the forecaster with this time-consuming weather-watch function by comparing the information in the FT's with the corresponding information on the surface airways observations. The FT monitoring program, called MONITR makes use of two sets of criteria to determine whether or not a problem exists with a particular FT. In both the amendment and alert cases, the forecaster still has the final responsibility to decide whether or not the FT should be amended. GRA

N86-16844# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR MID-AUGUST TO MID-SEPTEMBER 1985, VOLUME 39, NUMBER 16, AUGUST 14, 1985
14 Aug. 1985 10 p
(PB85-243525) Avail: NTIS HC A02/MF A01 CSCL 04B

The report gives the precipitation and temperature weather outlook for periodic and seasonal variations for North America. GRA

N86-16845# National Academy of Sciences - National Research Council, Washington, D. C.
HURRICANES IWA, ALICIA AND DIANA, COMMON THEMES: A REPORT OF THE COMMITTEE ON NATURAL DISASTERS, 1984
1985 38 p
(Grant NSF CEE-82-19358)
(PB85-218220) Avail: NTIS HC A03/MF A01 CSCL 04B

The National Research Council has maintained the Committee on Natural Disasters-originally known as the Committee on Earthquake Inspection-since 1966. The goals of the committee are to collect perishable data on natural disasters while the data are still available, to provide conveniently available accounts of natural disasters, and to identify and recommend cases where more in-depth studies could improve engineering practice, preparedness, warning systems, public response, or recovery. At its annual meeting in November 1984 the committee decided the each year it should prepare a report presenting a generic analysis of one area of its work-postdisaster studies on earthquakes, hurricanes, tornadoes, floods, landslides, or volcanoes, as well as summarizing the committee's postdisaster study activities for the previous year. GRA

N86-16846# National Oceanic and Atmospheric Administration, Washington, D. C.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR MID-JUNE TO MID-JULY 1985, VOLUME 39, NUMBER 2, JUNE 14,

1985
14 Jun. 1985 9 p
(PB85-216547) Avail: NTIS HC A02/MF A01 CSCL 04B

The precipitation and temperature weather outlook for periodic and seasonal variations for North America is reported. GRA

N86-16847# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
METEOROLOGICAL EVENTS THAT PRODUCED THE HIGHEST GROUND-LEVEL CONCENTRATIONS DURING COMPLEX TERRAIN FIELD EXPERIMENTS
F. A. Schiermeier, T. F. Lavery, and D. C. DiCristofaro 1985 14 p Prepared in cooperation with Environmental Research and Technology, Inc., Concord, Mass.
(PB85-210854; EPA-600/D-85-114) Avail: NTIS HC A02/MF A01 CSCL 04B

The U.S. Environmental Protection Agency (EPA) is sponsoring the Complex Terrain Model Development project, a multi-year study to develop improved models for calculating ground-level air pollutant concentrations that result from large emission sources located in mountainous terrain. The project started with tracer and flow visualization experiments and fluid modeling for isolated, simple terrain features-Cinder Cone Butte (CCB), Idaho and the Hogback Ridge (HBR), New Mexico--and has progressed to the Full Scale Plume Study (FSPS), conducted at the Tracy Power Plant near Reno, Nevada during August 1984. The CCB and HBR experiments and related fluid modeling demonstrated the usefulness of the concept of a dividing-streamline height (Hs) in discriminating between essentially horizontal flow that goes around the sides of the terrain features and flow that goes up and over the terrain. An analysis of tracer gas concentrations showed that the highest concentrations occurred during direct impingement of plumes released at elevations near the height of the dividing streamline. GRA

N86-16848# National Severe Storms Forecast Center, Kansas City, Mo.
SEVERE THUNDERSTORM CASES OF 1984 Technical Memo, 1 Jan. 1984 - 31 Dec. 1984
J. E. Hales and H. G. Crowther May 1985 96 p
(PB85-210748; NOAA-TM-NWS-NSSFC-7) Avail: NTIS HC A05/MF A01 CSCL 04B

Severe thunderstorm occurrences are relatively infrequent in much of the United States. As a result, a forecaster only occasionally has an opportunity to forecast their development. This proves to be a problem, as certainly one of the more important factors in forecasting them is the level of experience an individual forecaster has. Realizing the importance that experience plays and difficulty involved for a meteorologist to study past cases, a summary was compiled of all the organized severe thunderstorm episodes of 1984. Included in each case were the times and locations of the severe weather along with specifics of the more noteworthy events. GRA

N86-16849# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
DIURNAL AND SPATIAL VARIABILITY OF LIGHTNING ACTIVITY IN CENTRAL FLORIDA DURING THE SUMMER
R. E. Lopez and R. L. Holle Mar. 1985 41 p
(PB85-210383; NOAA-TM-ERL-ESG-13) Avail: NTIS HC A03/MF A01 CSCL 04B

Lightning location data from central Florida for the summer months of 1983 are presented, to ascertain the diurnal development of space distributions of flash frequencies. The influence of the underlying topography and the resulting diurnal circulations on the time and place of lightning strokes are found to be substantial. In addition, the data show that lightning is relatively rare, and exhibits a very large day-today variability. The utility of the type of data employed to study the characteristics not only of lightning as such, but also of topographically induced convection in general is emphasized. GRA

N86-16850# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
CLIMATOLOGY AND CONDITIONAL CLIMATOLOGY OF SUMMER PRECIPITATION IN NORTHEAST COLORADO
G. M. Williams Apr. 1985 55 p
(PB85-210375; NOAA-TM-ERL-ESG-11) Avail: NTIS HC A04/MF A01 CSCL 04B

Selected climatology and conditional climatology summaries of summertime convective rainfall were compiled for northeasthern Colorado in support of a forecast experiment conducted in Boulder. Interesting diurnal trends appear in the data. Peak probabilities of rainfall are shown to occur from early afternoon in the foothills to early evening on the eastern plains. Moreover, climatologies conditioned on rain are much different from those conditioned on no rain, and they clearly demonstrate the short-lived nature of convective precipitation. GRA

N86-16851# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
SUMMARY OF METEOROLOGICAL PRODUCT USAGE DURING THE PROFS CONVECTION FORECAST EXERCISE OF 1983
D. C. Walker and P. Schultz Apr. 1985 28 p
(PB85-210367; NOAA-TM-ERL-ESG-12) Avail: NTIS HC A03/MF A01 CSCL 04B

During the summer of 1983, the Program for Regional Observing and Forecasting Services (PROFS) conducted is third convective season forecast exercise. One hundred and eight meteorological products including satellite and radar imagery, displays of data in contour and streamline formats, and plots of surface and upper air data were available to the forecasters on the PROFS workstation. Each product was available on one of four scales, each scale covering a specific, successively smaller, geographic area. Througout the exercise a record was kept of the number of times each product was selected by he workstation forecasters. Examination of the resulting product usage patterns reveals high use of image products and a preference for plotted observations over contour and streamline products. Products on the local scale were the most often used. Author (GRA)

N86-16852# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data and Information Service.
DETECTION OF HIGH LEVEL TURBULENCE USING SATELLITE IMAGERY AND UPPER AIR DATA
G. P. Ellrod Apr. 1985 36 p
(PB85-208452; NOAA-TM-NESDIS-10) Avail: NTIS HC A03/MF A01 CSCL 04B

The primary cloud patterns observed in satellite imagery which relate to high altitude nonconvective turbulence are described. Relative frequencies, prevailing altitudes and intensities of each type are presented. Means of distinguishing turbulent from nonturbulent cloud signature based on both satellite imagery and upper wind data are also provided. GRA

N86-16853# National Weather Service, Silver Spring, Md. Office of Meteorology.
WATCH/WARNING VERIFICATION, 1982 AND 1983: FLASH FLOOD, WINTER STORM AND HIGH WIND
A. K. Campbell Jan. 1985 71 p
(PB85-204899; NOAA-TM-NWS-FCST-30) Avail: NTIS HC A04/MF A01 CSCL 04B

A limited program was begun in 1979 to develop a measure of watch/warning forecast performance for flash flood, winter storm and high wind. Weather Service forecast offices provide verification logs to national headquarters for this purpose. These logs consist of issue time, valid time, lead time, area, verification for watches and warnings, and events that occur in the absence of a watch or warning. A total of 438 flash flood, 186 winter weather and 111 high wind events were reported on the logs in 1982. In 1983 a total of 414 flash floods, 147 winter weather and 80 high wind events were reported on the logs. Collectively, 11 percent of those of thse events occurred without a watch or warning being issued. Of the total warnings disseminated 79 percent showed positive

verification, but 36 percent of those were issued with an event in progress. Author (GRA)

N86-16854# National Weather Service, Garden City, N.Y.
CERR: AN AVIATION VERIFICATION PROGRAM
M. R. Peroutka Apr. 1985 28 p
(PB85-204824; NOAA-NWS-ERCP-30) Avail: NTIS HC A03/MF A01 CSCL 04B

Aviation verification statistics have been computed for Cleveland forecasters since 1980. For most of these years, the computations were done by hand, and a simple statistic had to be developed. The CERR program was developed soon after the National Verification Programs began to run, and it has replaced all the manual computations. The statistic chosen for verification was the average MOS category error. This statistic is simply the absolute value of the difference between the category forecast and the category observed. Scores are computed for each forecaster and guidance at each station for each period forecast. The percent improvement over guidance is also computed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-16855*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE-DERIVED SEA SURFACE TEMPERATURE: WORKSHOP 3
15 Oct. 1985 181 p refs Workshop held in Pasadena, Calif., 22-24 Feb. 1984 Original contains color illustrations 3 Vol.
(Contract NAS7-918)
(NASA-CR-176455; JPL-Pub-85-63; NAS 1.26:176455) Avail: NTIS HC A09/MF A01 CSCL 08J

This is the third of a series of three workshops, sponsored by the National Aeronautics and Space Administration, to investigate the state of the art in global sea surface temperature measurements from space. Three workshops were necessary to process and analyze sufficient data from which to draw conclusions on the accuracy and reliability of the satellite measurements. In this workshop, the final two (out of a total of four) months of satellite and in situ data chosen for study were processed and evaluated. Results from the AVHRR, HIRS, SMMR, and VAS sensors, in comparison with in situ data from ships, XBTs, and buoys, confirmed satellite rms accuracies in the 0.5 to 1.0 C range, but with variable biases. These accuracies may degrade under adverse conditions for specific sensors. A variety of color maps, plots, and statistical tables are provided for detailed study of the individual sensor SST measurements. For individual titles, see N86-16856 through N86-16862.

N86-16856*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA SETS AND PRODUCTS
Jeffrey E. Hilland and Eni G. Njoku *In its* Satellite-Derived Sea Surface Temperature 15 Oct. 1985 12 p refs (For primary document see N86-16855 07-48)
Avail: NTIS HC A09/MF A01 CSCL 08J

Against background of spacecraft and in situ measurements, participants at the JPL workshops sought to review the sensor performance, understand the different SSt retrieval algorithms, evaluate the sensor SST accuracies, and discuss directions for future sensor development. The issue of utilization of satellite SSTs in climate, air sea interaction, and mesoscale oceanography studies was not the main focus of the workshops, but did have a bearing on the recommendations that arose from the discussions. More date were available for analysis with the acquisition of AVHRR (MCSST), HIRS/MSU, and VAS data sets. In Workshop 3 the acquisition and analysis fo data were completed, recommendations for future research and sensor development were discussed, and plans were made for eventual publication of results from the workshop series in the open literature. Author

N86-16857*# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data, and Information Service.
ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) SENSOR COMPARISON CHARACTERISTICS
E. Paul McClain *In* JPL Satellite-Derived Sea Surface Temperature 15 Oct. 1985 17 p refs (For primary document see N86-16855 07-48)
Avail: NTIS HC A09/MF A01 CSCL 08J

Advantages and limitations of the AVHRR multichannel sea surface temperature (MCSST) detecting technique using NOAA satellites are discussed. The error characteristics of MCSST's from statistical tables and regional AVHRR error characteristics from global anomaly charts are also discussed. Some soruces of errors and positive findings are reviewed. E.R.

N86-16858*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RETRIEVAL OF SEA-SURFACE TEMPERATURES FROM HIRS2/MSU
Joel Susskind and D. Reuter *In* JPL Satellite-Derived Sea Surface Temperature 15 Oct. 1985 18 p refs (For primary document see N86-16855 07-48)
Avail: NTIS HC A09/MF A01 CSCL 08J

The methods used at the Goddard Laboratory for Atmospheres to retrieve sea surface temperatures from HIRS2/MSU data for the four months of the NASA sea surface temperature intercomparison workshop are described. Results are shown comparing anomaly fields produced using data from ships, AVHRR, HIRS2/MSU, SMMR AND VAS for the last three of these months. Fields from AVHRR and HIRS2 show the highest accuracy compared to ship fields. Errors in the HIRS2 fields appear more random while AVHRR data shows large area, spatially coherent errors. The random errors in the HIRS2 fields can be further reduced by performing the retrievals at a higher spatial resolution. Author

N86-16859*# Wisconsin Univ., Madison. Space Science and Engineering Center.
SEA SURFACE TEMPERATURES FROM VAS MSI DATA
John J. Bates *In* JPL Satellite-Derived Sea Surface Temperature 15 Oct. 1985 7 p refs (For primary document see N86-16855 07-48)
Avail: NTIS HC A09/MF A01 CSCL 08J

The results of the SST intercomparison workshop series are the first examination of monthly mean SSTs derived from MSI data provided by the VAS instrument on the GOES series satellites. The most significant change in deriving the SST's was the use of the three window channel algorithm in the processing of the July data as opposed to the use of only the two window channel algorithm for the March data. In addition, further satellite/buoy matches indicated that the triple window channel algorithm showed a smaller standard deviation than the two window channel algorithm and was less sensitive to the effects of volcanic aerosol contamination and low level inversion conditions. This is due to the smaller brightness temperature attenuation by aerosols and water vapor at 3.9 microns than at 11.0 and 12.6 microns. Thus, the decision was made to use the best product (i.e., the three window channel aglorithm) for processing the July data. Author

N86-16860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BLENDED SST FIELDS COMBINED SMMR/SHIP DATA (SUMMARY OF TECHNIQUE)
Thomas T. Wilheit and Daesoo Han (Systems and Applied Sciences Corp., Hyattsville, Md.) *In* JPL Satellite-Derived Sea Surface Temperature 15 Oct. 1985 5 p refs (For primary document see N86-16855 07-48)
Avail: NTIS HC A09/MF A01 CSCL 08J

All remote sensors have bias problems which vary in space and time. The infrared measurements are very sparse in cloudy

areas: the SMMR has coverage limitations due to the interference of land areas and only half time operation. If one simply averaged the data from these various sources, the combination of the biases and varying sampling would introduce artifacts into the analyzed product which would reflect the sampling and which could be quite misleading. The remote sensors provide reasonable estimates of gradients of SST over length scales greater than the sensor resolution but smaller than hemispheric. Ships can be considered unbiased but are poorly distributed on small scales except in the densest shipping lanes. An analysis scheme based on a suggestion by Holl was developed which exploits just this approximately complementarity to provide an improved SST analysis. The resulting accuracy appears to be in the required approx. 0.5 C range for the particular case of using SMMR and ship data to produce two degree latitude by two degrees longitude monthly analyses. Author

N86-16861*# Scripps Institution of Oceanography, La Jolla, Calif.
INTERCOMPARISON OF GLOBAL SST FIELDS DERIVED FROM SATELLITE SENSORS AND SHIP OBSERVATIONS
Stephen E. Pazan *In* JPL Satellite-Derived Sea Surface Temperature 15 Oct. 1985 13 p refs (For primary document see N86-16855 07-48)
Avail: NTIS HC A09/MF A01 CSCL 08J

Near global comparisons were made between binned forms of SST obtained from different instruments, ship meteorological observations, and the output of a meteorological model. Binning hereinafter means gridding by simple summation of data values in a bin, which in this study was a 2 deg. x 2 deg. box or a 10 deg. x 10 box surrounding a grid node. In the binned comparisons, the question is asked: are the binned data from two instruments drawn from the same population? The first two measures of statistical moments of the populations are used to test the hypothesis that they are. Comparisons were also attempted between raw forms of the various SST retrievals, using a structure function analysis. The results of this analysis were relatively uninteresting and are therefore omitted. Author

N86-16862*# Western Australian Inst. of Tech., Bentley. School of Physics and Geosciences.
REQUIREMENTS FOR SEA SURFACE TEMPERATURE GROUND TRUTH IN THE INDONESIAN REGION
John Penrose *In* JPL Satellite-Derived Sea Surface Temperature 15 Oct. 1985 2 p refs (For primary document see N86-16855 07-48)
Avail: NTIS HC A09/MF A01 CSCL 08J

The comparatively low density of ship and XBT observations in large areas of the Southern Hemisphere and the tropics limits the extent to which satellite SST estimates can be validated on a global basis. These limitations are discussed, and some recommendations for correction are given. E.R.

N86-16863*# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
ANALYSIS OF A METHOD FOR PRECISELY RELATING A SEAFLOOR POINT TO A DISTANT POINT ON LAND Annual Report, 15 May 1983 - 14 May 1985
F. N. Spiess, C. D. Lowenstein, and M. O. McIntyre May 1985 22 p refs
(Grant NAG5-320)
(NASA-CR-176474; NAS 1.26:176474) Avail: NTIS HC A02/MF A01 CSCL 08J

A study of the environmental constraints and engineering aspects of the acoustic portion of a system for making geodetic ties between undersea reference points and others on land is described. Important areas in which to make such observations initially would be from the California mainland out to oceanic points seaward of the San Andreas fault, and across the Aleutian Trench. The overall approach would be to operate a GPS receiver in a relative positioning (interferometric) mode to provide the long range element of the baseline determination (10 to 1,000 km) and an array of precision sea floor acoustic transponders to link the locally moving sea surface GPS antenna location to a fixed sea floor point. Analyses of various environmental constrants (tides, waves, currents, sound velocity variations) lead to the conclusion that, if one uses a properly designed transponder having a remotely controllable precise retransmission time delay, and is careful with regard to methods for installing these on the sea floor, one should, in many ocean locations, be able to achieve sub-decimeter overall system accuracy. Achievements of cm accuracy or better will require additional understanding of time and space scales of variation of sound velocity structure in the ocean at relevant locations. Author

N86-16864# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
STANDARDIZED WIND AND WAVE ENVIRONMENTS FOR NORTH PACIFIC OCEAN AREAS Final Report
W. T. Lee, S. L. Bales, and S. E. Sowby Jul. 1985 616 p
(AD-A159393; DTNSRDC/SPD-0919-02) Avail: NTIS HC A99/MF A01 CSCL 08/3

This report is a source document for specifying wind and wave conditions for the North Pacific Ocean. The data are derived from the U.S. Navy's Spectral Ocean Wave Model (SOWM) hindcast wind and wave climatology. Some initial efforts by the Navy to synthesize the hindcasts into design tools are presented in this report. The report provides seasonal and geographic distributions of wind and wave parameters and specifies mathematical models by which wave spectra, required by any ship seakeeping performance methodology, can be developed. Long-term extreme wave predictions for fatigue analysis are also discussed. Author (GRA)

N86-16865# Oregon State Univ., Corvallis. Coll. of Oceanography.
CARBONATE CHEMISTRY OF THE BERING SEA
C. T. A. Chen, C. L. Wei, and M. R. Rodman Sep. 1985 93 p
(Contract DE-AT06-81EV-10611)
(DE85-017884; DOE/EV-10611/5) Avail: NTIS HC A05/MF A01

Wintertime oxygen, pH, alkalinity and calcium profiles across the marginal ice zone of the central and southeastern Bering Sea shelf were analyzed and compared with summer data. During the winter, at water depths shallower than 75m, the water column is homogeneous and near freezing. Between the 75 and 200m isobaths the structure is essentially two-layered, a cool and fresh upper layer overlying a warmer, more saline bottom layer. The oxygen degree of saturation in most of the bottom mixed layer on the shelf in winter is higher than in the surface water in winter and the bottom water in summer. In summer the oxygen and carbonate data show extreme variability governed primarily by biological processes. Winter oxygen and carbonate data, however, do not scatter as much as the summer data and indicate conservative mixing of several sub-surface water masses. The winter surface water is undersaturated in both oxygen and carbon dioxide and seems to absorb oxygen, but little carbon dioxide, from the atmosphere. Alkalinity and calcium data show large river influence. All T/S and chemistry data indicate that the deep shelf water is a mixture of surface shelf water and surface Aleutian Basin water. Oxygen data indicate that the annual sea ice impedes, but does not stop, the air-sea exchange of gases. Excess CO2 signal has been calculated based on our data and data from literature. The shelf water is saturated with excess CO2 but it could not be detected below 1000 m in the Aleutian Basin. Altogether the Bering Sea contains 0.19 +- 0.05 x 10 to the 15th power g excess carbon. DOE

N86-16866# Institute of Oceanographic Sciences, Wormley (England).
GREAT METEOR EAST (DISTAL MADEIRA ABYSSAL PLAIN): GEOLOGICAL STUDIES OF ITS SUITABILITY FOR DISPOSAL OF HEAT-EMITTING RADIOACTIVE WASTES
R. C. Searle, P. J. Schultheiss, P. P. E. Weaver, M. J. Noel, R. B. Kidd, C. L. Jacobs, and Q. J. Huggett 1985 163 p refs Sponsored by UK Department of the Environment
(IOS-193; DoE/RW/84/32; DGR-481/179) Avail: NTIS HC A08/MF A01

Geological and geophysical studies were carried out in an

area of the Madeira Abyssal Plain to assess its suitability for the disposal of heat-emitting radioactive waste. The area appears to have many of the characteristics required for a disposal site, although few of these characteristics are the best that can be found in the world's oceans. The area is in a region of low volcanic and seismic activity, though quieter areas (especially with regard to volcanism) could be found. It is well away from major tectonic activity, but the sediments may be undergoing faulting at depth, possibly as a result of differential compaction. No evidence of high pore-water advection is found, but the possibility of it occurring along faults or through open burrows in the sediments needs to be explored. Although the reduced nature of the sediments may be advantageous in causing sorption of some anions, there is evidence of enhanced mobility of other ions. Author (ESA)

N86-16867# Institute of Oceanographic Sciences, Wormley (England).

BENTHIC BOUNDARY LAYER, IOS OBSERVATIONAL AND MODELLING PROGRAM Final Report, Jan. 1985

P. M. Saunders and K. J. Richards 1985 63 p refs Sponsored by UK Department of the Environment

(IOS-199; DoE/RW/85/027; DGR-481/176) Avail: NTIS HC A04/MF A01

Near bottom currents, measured at three sites in the NE Atlantic, reveal the eddying characteristics of the flow. At the boundaries of eddies benthic fronts form providing a path for upward displacement of the bottom water. The flux of heat into the bottom of the Iberian basin through Discovery Gap is deduced from year long current measurements. The flux is supposedly balanced by geothermal heating through the sea floor and diapycnal diffusion in the water. Diffusion within oceanic eddies is shown to obey a law found for atmospheric cyclones and anticyclones. Diffusion by eddies is determined largely by their energy. If a tracer is discharged from the sea bed the volume of sea water in which it is found increases with time and after 20 yr fills an ocean basin of 1000 km square to a depth of only 1 to 2 km.

Author (ESA)

N86-16868# Institute of Oceanographic Sciences, Wormley (England).

S2EASoar CTD SECTIONS IN THE NORTHEAST ATLANTIC OCEAN COLLECTED DURING RRS DISCOVERY CRUISE 132

R. T. Pollard, D. Holford, and K. Sherrocks 1985 62 p refs (Contract EEC-CL115UK(H))

(IOS-200) Avail: NTIS HC A04/MF A01

Frontal CTD structures in an area of the Atlantic Ocean considered for radioactive waste disposal were surveyed. The data set consists of 1 sec averages of time, pressure, temperature, salinity, potential temperature, oxygen, Chlorophyll a, sigmatheta, latitude, longitude, and distance run along the SeaSoar track. Speed through the water is 4 m/sec, so that individual points are 4 m apart horizontally, and 1 m apart vertically. Down and up traces are used in all plots and there is a profile (down or up) every 1.5 km. The 1 sec data were averaged over 7.5 dbar pressure intervals to reduce the number of points plotted and accommodate the maximum number of points contourable in a computer run. Author (ESA)

N86-16869# Institute of Oceanographic Sciences, Wormley (England).

AN INSTRUMENT TO MEASURE DIFFERENTIAL PORE PRESSURES IN DEEP OCEAN SEDIMENTS: POP-UP-PORE PRESSURES (PUPPI)

P. J. Schultheiss, P. J. McPhail, A. R. Packwood, and B. Hart 1985 57 p refs Sponsored by UK Department of the Environment

(IOS-202; DoE/RW/84/165; DGR-481/179) Avail: NTIS HC A04/MF A01

A Pop-Up-Pore-Pressure-Instrument (PUPPI) to measure differential pore pressures in sediments was developed. The differential pressure is the pressure above or below normal hydrostatic pressure at the depth of the measurement. It is designed to operate in water depths up to 6000 m for periods of weeks or months and measures differential pore pressures at depths of up to 3 m into the sediments with a resolution of 0.05 kPa. It is a free-fall device with a lance which penetrates the sediments. This lance and the ballast weight is disposed when the PUPPI is acoustically released from the sea floor. When combined with permeability and porosity values of deep-sea sediments the pore pressure measurements made using the PUPPI suggest advection velocities as low as 8.8 mm/yr. The mechanical, electrical and acoustic systems are described together with data obtained from shallow and deep water trials. Author (ESA)

N86-16870# Institute of Oceanographic Sciences, Wormley (England).

GEOPHYSICAL INTERPRETATION OF THE STRUCTURE AND EVOLUTION OF THE JAN MAYEN RIDGE

C. D. Pelton 1985 38 p refs

(IOS-205) Avail: NTIS HC A03/MF A01

The Jan Mayen Ridge and its Southern Ridge Complex, part of a continental block which was rifted from the Greenland continental margin during the Mid-Eocene, was studied. Multichannel seismic data interpreted with published geophysical data permits work to be carried out on improved positions for the Southern Ridge Complex basement ridges. Isochron compilations are made for two important seismic events: Horizon A, which is mapped, and Horizon O which, with depth-to-basement values, is used to construct an improved total sediment thickness map. The change in spreading conditions along the eastern flank of the Jan Mayen Block is examined. A revised ocean/continent boundary for the Jan Mayen Block is derived. Author (ESA)

N86-16871# Institute of Oceanographic Sciences, Wormley (England).

MAGNETIC ANOMALIES IN THE NORTHEAST ATLANTIC

D. G. Roberts, M. T. Jones, and P. M. Hunter 1985 60 p refs

(IOS-207) Avail: NTIS HC A04/MF A01

A pair of geomagnetic anomaly charts printed on a Mercator projection at a scale of 1:2.4 million for the region of the northeast Atlantic from 32 to 62 N and from 0 to 31 W is presented. The charts are compiled from observations along ship's tracks up to 1975. Magnetic anomalies are calculated with respect to the International Geomagnetic Reference Field 1965.0. The charts complement are at the same scale as the bathymetric series Bathymetry of the northeast Atlantic published by the UK Hydrographic Department. Author (ESA)

N86-16872# Institute of Oceanographic Sciences, Wormley (England).

A REVIEW OF THE KNOWN BIOLOGICAL CHARACTERISTICS OF THE GREAT METEOR EAST SITE TOGETHER WITH A SAMPLING PROGRAM FOR A BIOLOGICAL SITE ASSESSMENT

H. S. J. Roe 1985 36 p refs Sponsored by UK Department of the Environment

(IOS-211; DoE/RW/85/080) Avail: NTIS HC A03/MF A01

Biological information on the Great Meteor East (GME) site in the Atlantic is reviewed. There is very little data available from depths below 2000 m. There is virtually no direct benthic information and none at all on the midwater/benthic boundary layer. Data from a wider geographic area are relevant to GME but the applicability of such data varies according to the hydrography. A sampling program which allows a comprehensive quantitative and qualitative assessment of the midwater and benthic ecosystems is outlined. Interactions between benthic and midwater communities just above the sea floor are emphasized. Author (ESA)

N86-16873# SES, Inc., Springfield, Va.

PATHWAYS AND FUTURE DIRECTIONS FOR ENVIRONMENTAL DATA AND INFORMATION USERS

Oct. 1984 433 p Proceedings of conference held in Denver, Colo., 19-22 Aug. 1984

(Contract NA83-SA-C-00754)

(PB85-233377; NESDIS-CONF-84-2) Avail: NTIS HC A19/MF A01 CSCL 08J

The interdisciplinary use of environmental data and information available from NOAA's National Environmental Satellite, Data, and Information Services (NESDIS) data centers are presented. Topical areas include activities as: (1) legal and insurance industries; (2) business, commodities, manufacturing, trave and recreation, (3) public and environmental health; (4) communications; (5) the marine environment, research and academia; disaster preparedness, and resource management. Future plans for on-line services and the technology transfer program of NOAA are described.GRA

N86-16874# National Oceanic and Atmospheric Administration, Washington, D. C. Oceanographic and Meteorological Labs.
ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORY, FISCAL YEAR 1984 Annual Report
Jan. 1985 62 p
(PB85-218014) Avail: NTIS HC A04/MF A01 CSCL 08C

The mission NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) is to conduct a basic and applied research program in oceanography characteristics and processes of the ocean and the atmosphere both separately and as a coupled system. Oceanographic investigations center on the fluxes of energy, momentum, and materials through the air-sea interface; the transport and composition (thermal and chemical) of water in the ocean volume; and hydrothermal processes of mineralization at seafloor spreading centers. Meteorological research is carried out to improve the description, understanding, and prediction of hurricanes. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-16875*# Alabama Univ., Birmingham. Comprehensive Cancer Center.
PROTEIN CRYSTAL GROWTH RESULTS FROM SHUTTLE FLIGHT 51-F Final Report
Charles E. Bugg 17 Oct. 1985 7 p
(Contract NAS8-36611)
(NASA-CR-178540; NAS 1.26:178540) Avail: NTIS HC A02/MF A01 CSCL 06C

The protein crystal growth (PCG) experiments run on 51-F were analyzed. It was found that: (1) sample stability is increased over that observed during the experiments on flight 51-D; (2) the dialysis experiments produced lysozyme crystals that were significantly larger than those obtained in our identical ground-based studies; (3) temperature fluctuations apparently caused problems during the crystallization experiments on 51-F; (4) it is indicated that teflon tape stabilizes droplets on the syringe tips; (5) samples survived during the reentry and landing in glass tips that were not stoppered with plungers; (6) from the ground-based studies, it was expected that equilibration should be complete within 2 to 4 days for all of these vapor-diffusion experiments, thus it appears that the vapor diffusion rates are somewhat slower under microgravity conditions; (7) drop tethering was highly successful, all four of the tethered drops were stable, even though they contained MPD solutions; (8) the PCG experiments on 51-F were done to assess the hardware and experimental procedures that are developed for future flights, when temperature control will be available. Lysozyme crystals obtained by microdialysis are considerably larger than those obtained on the ground, using the identical apparatus and procedures. E.A.K.

N86-16876# Army Research Inst. of Environmental Medicine, Natick, Mass.
A SYSTEM OF RAT RESTRAINT USING A CONE-SHAPED, PLEXIGLASS AND STAINLESS STEEL ROD CAGE
G. J. Thomas, C. B. Matthew, W. T. Matthew, and R. Hubbard 1 Feb. 1985 19 p
(DA Proj. 3E1-62777-A-879)
(AD-A158428; USARIEM-T6/85) Avail: NTIS HC A02/MF A01 CSCL 14/2

A system of rat restraint was needed to allow maximum accessibility to the animal. This system, designed inhouse, is constructed of 3/8-in plexiglass and stainless steel rods. Several special design features, including the adjustment of size to accomodate a wide weight range of animals, are superior to commerical varieties. This system has been used extensively in two published studies and other uncompleted studies and has adapted well to many applications. GRA

N86-16877# Army Research Inst. of Environmental Medicine, Natick, Mass.
SIMULTANEOUS DETERMINATION OF FLUID SHIFTS DURING THERMAL STRESS IN A SMALL ANIMAL MODEL
M. J. Durkot, O. Martinez, D. Brooks-McQuade, and R. P. Francesconi Sep. 1985 21 p
(DA Proj. 3M1-61102-BS-10)
(AD-A159363; USARIEM-M-39/85) Avail: NTIS HC A02/MF A01 CSCL 06/19

We have developed methodology to measure simultaneously fluid redistribution among the major compartments during moderate and severe hypohydration. Total body water (TBW) was determined using tritiated water, extracellular fluid volume, (ECF) was measured using a single injection C-14 insulin technique, and plasma volume (PV) was determined by cardio-green dye dilution. Moderate (10% decrease in body weight) and severe (15%) hypohydration resulted in significant losses in TBW, ECF and PV. Plasma volume was decreased by approximately 25% in both groups, and other fluid compartments were differentially affected. For example, the moderately dehydrated group maintained PV by shifting fluid from the ECF and ISF (interstitial fluid) compartment while preserving the ICF (intracellular fluid) conversely, the severely dehydrated group maintained PV by redistributing fluid from both the ECF and ICF compartments. The data indicated that the initial response to fluid loss was the movement of fluid from the ECF pool to sustain both PV and ICF. In severely hypohydrated rats, PV was maintained at the expense of ICF. These experiments indicate that PV and ICF are maximally protected, probably to preserve the integrity of the cardiovascular system and to minimize organ injury. GRA

N86-16878# Texas Univ., Austin. Lab. of Radiation Biology.
PHYSICO-CHEMICAL STUDIES OF RADIATION EFFECTS IN CELLS Progress Report, 15 Feb. 1984 - 14 Feb. 1985
E. L. Powers 1985 13 p refs
(Contract DE-AS05-76EV-03408)
(DE85-014681; DOE/EV-03408/T1) Avail: NTIS HC A02/MF A01

The radioprotective effects of Hg(++) were investigated in Staphylococcus aureus and Pseudomonas aeruginosa bacteria having very different gc ratios in their DNA. A protective effect is seen in both with first order curves or at least in the k/sub L/ region of the breakpoints. However, it is curious that there is a distinct difference in the metal-free N2 baseline of Staphylococcus aureus compared to its EtOH metal-free N2 response while with Pseudomonas aeruginosa both the metal-free N2 baseline and its EtOH metal-free results are similar. In related studies a new radioprotective substance was evaluated in bacterial systems. Results showed that, in the presence of Rh(NH3)3C/3, the anoxic cell shows greater sensitivity than the oxygenated cell. This compound has considerable therapeutic promise providing it acts the same on mammalian cells. DOE

N86-16879# Research Inst. of National Defence, Stockholm (Sweden). Dept. 5.
BIOLOGICAL EFFECTS OF MILLIMETER WAVES ON THE MOUSE
C.-O. Criborn, Ch. Henriksson, and L. D. Wernlund Aug. 1985 17 p refs In SWEDISH; ENGLISH summary
(FOA-C-50023-H1; ISSN-0347-7665) Avail: NTIS HC A02/MF A01

To study the effects of millimeter waves on respiration, rectal temperature, and of an acoustic reaction on mice, animals aged 60 to 70 days, weighing 25 to 30 g, were irradiated by 2 different

oscillators with a power intensity of 10 mW/sqcm at frequencies of 35 and 94,3 GHz. The absorbed irradiation was converted into heat which the mouse compensated for by decreased respiratory minute volume. The acoustic reaction was acutely affected in positive or negative direction depending on the frequency. The effects return to normal values 5 to 20 min after irradiation. No significant variation of the body temperature is noted.

Author (ESA)

N86-16880# National Academy of Sciences - National Research Council, Washington, D. C.

MODELS FOR BIOMEDICAL RESEARCH: A NEW PERSPECTIVE

1985 190 p

(Contract NO1-RR-3-2112)

(PB85-240067; ISBN-0-309-03538-4; LC-85-60945) Avail: NTIS HC A09/MF A01 CSCL 06E

Models for Biomedical Research provides a historical summary of the concept and use of models and their contributions to biomedical knowledge, evaluations of the utility of nonmammalian models, with particular attention to nonmammalian vertebrates, invertebrates, microorganisms, cell and tissue culture systems, and mathematical models. The report proposes a new perspective on the role of models, whereby they serve as sources of information that can be generalized to the total body of biological knowledge rather than directly, or only, to humans. In the course of the study six workshops were held to explore the use of models in various aspects of biomedical research. Summaries of the workshops are included as appendices to the report.

Author (GRA)

N86-16881# Joint Publications Research Service, Arlington, Va.

USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES

10 Dec. 1985 78 p refs Transl. into ENGLISH from various Russian articles

(JPRS-UBB-85-025) Avail: NTIS HC A05/MF A01

Progress on research and developments in the Soviet life, biomedical, and behavioral sciences, is reported. Topics discussed include: aerotechnology, biochemistry, bionics, biotechnology, epidemiology, genetics, human factors engineering, immunology, medicine, laser effects, molecular biology, pharmacology, and toxicology, physiology, and public health. For individual titles, see N86-16882 through N86-16886.

N86-16882# Joint Publications Research Service, Arlington, Va.

ADVANCES IN NERVE CELL RESEARCH **c52**

Ye. Chazov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UB-85-025) 10 Dec. 1985 p 2-4 Transl. into ENGLISH from Pravda (Moscow), 16 Aug. 1985 p 6 (For primary document see N86-16881 07-51)

Avail: NTIS HC A05/MF A01

All excitability which is dependent on the existence of molecular structure of the cell membrane, the ion channels, is discussed. The systems operation of living organisms depends on the fine coordination of the ion channel action. Ion channels contribute to initiation of cardiac and smooth muscle contraction, endocrine secreation of enyzmes and hormones, cell growth and division, and regulation of cell metabolism. Approches towards the development of methods to control the action of ion channels and the function of nerve cells are identified. E.A.K.

N86-16883# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF PEROXIDE OXIDATION OF LIPIDS DURING STRESS Abstract Only

E. M. Mikayelan and V. G. Mkhitaryan *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-85-025) 10 Dec. 1985 p 11 Transl. into ENGLISH from Biologicheskiy Zhurnal Armenii (Yerevan, USSR), v. 38, no. 5, May 1985 p 393-398 (For primary document see N86-16881 07-51)

Avail: NTIS HC A05/MF A01

The dynamics of peroxide oxidation of lipids (POL) was studied on white rats during acute stress of varying duration and during chronic stress. Alterations in formation and removal of lipoperoxides, the direction and intensity depending on the stage of stress and on tissue specificity are shown. During acute stress, POL intensified, especially in the heart. It is shown that alpha-tocopherol levels in blood and in erythocyte membranes dropped during acute stress, while they remained stable in the heart, liver and brain. Repeated stress intensified the POL and activated the glutathioneperoxidase-glutathionereductase system. Under chronic stress, the POL dimished, alpha tocopherol levels in tissues became lower in all phases of the stress, altering the structure and function of biomembranes and necessitating antioxidative prophylactic measures and therapeutic interventions because the cell metabolism was comprised. E.A.K.

N86-16884# Joint Publications Research Service, Arlington, Va.

PEPTIDES AND MEMORY **c53**

L. Ivchenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-85-025) 10 Dec. 1985 p 31-34 Transl. into ENGLISH from Izvestiya (Moscow, USSR), 1 Aug. 1985 p 8 (For primary document see N86-16881 07-51)

Avail: NTIS HC A05/MF A01

The function of the peptides on the mechanism of memory was investigated. It was shown that the hormones of the hypophysis - corticotropin and vasopressin, could be memory stimulants. It is found that peptide substances have a great influence on the central nervous system. The production of synthetic vasopressin is recorded. E.A.K.

N86-16885# Joint Publications Research Service, Arlington, Va.

MITOCHONDRIAL MANIFESTATIONS OF STRESS AND RESPONSE TO HORMONAL STIMULATION AND HYDROAEROIONS Abstract Only

M. N. Kondrashova and Ye. V. Grigorenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-85-025) 10 Dec. 1985 p 35 Transl. into ENGLISH from Zhurnal Obshchey Biologii (Moscow, USSR), v. 46, no. 4, Jul. - Aug. 1985 p 516-526 (For primary document see N86-16881 07-51)

Avail: NTIS HC A05/MF A01

Hepatic and cerebral mitochondrical suspensions obtained from Wistar and August rats were studied to assess the effects of immobilization stress. The mitochondrial preparations exhibited manifestations of stardard biphasic response of physiological stress, which consisted of an initial enhancement of energy metabolism which was reflected in increased succinate oxidation and elevated respiratory rate. These changes were consonant with an initial upsurge in epinephrine release into the blood stream. With ongoing stress, succinate oxidation shows a corresponding increase accompanied, however, by greater increase in an antithetical process-inhibition of succinate dehydrogenase by oxalacetate and the products of serotonin oxidation. Treatment of the stressed animals with sightly charged negative hydroaeroions abrogated the latter effects, and resulted in an increase in mitochondrial respiration to above-background levels. The rapid change seen with the hydroaerions is ascribed to electrobiochemical mechanisms which is responsible for enzyme activation. E.A.K.

N86-16886# Joint Publications Research Service, Arlington, Va.

CYTOGENETIC CHANGES IN CELLS OF LETTUCE SEEDLINGS WITH EXPOSURE TO ACCELERATED CARBON ION BEAM

A. I. Vikhrov, Ye. Ye. Kovalev, Ye. N. Maksimova, L. V. Mevzgodina, and Yu. V. Potapov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-85-025) 10 Dec. 1985 p 62-68 refs Transl. into ENGLISH from Radiobiologiya (Moscow, (For primary document see N86-16881 07-51)

Avail: NTIS HC A05/MF A01

The effects of single hits on accelerated carbon ions in the lettuce seeds were studied. Data on the frequency of aberrant cells in lettuce seedlings as a function of the number of hits after exposure to C carbon ions are presented. The number of particles, which passed through the biological objects, and the dose values, received by each seed considering the contribution of secondary radiation in these doses, are presented. E.A.K.

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-16887 Pennsylvania Univ., Philadelphia.
TRANSPORT OF ARTERIAL BLOOD GATES THROUGH HUMAN SKIN Ph.D. Thesis
James Edward Baumgardner 1985 149 p
Avail: Univ. Microfilms Order No. DA8515346

The physiology of the transport of arterial blood gases through human skin has important applications in non-invasive monitoring. A simple analytical model has been developed that relates flux of arterial gas through skin to arterial tension, skin blood flow, skin diffusional resistance, and skin metabolism. In addition, a mass specreal approach has been devised to accurately measure gas flux through human skin. Flux of helium and oxygen through human skin at constant temperature is well-described by the simple linear analytical model. Increasing surface temperature in the range 33-43 C results in a much larger increase in oxygen efflux than in helium efflux for intact skin. Skin perfusion was approximated from helium efflux for skin that had been stripped with cellophane tape. Estimates of skin perfusion compare favorably to previously reported values obtained by other techniques. Values for skin perfusion were combined with helium and oxygen data to calculate skin diffusion conductance. Dissert. Abstr.

N86-16888* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Nov. 1985 74 p
(NASA-SP-7011(277); NAS 1.21:7011(277)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 205 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1985. Author

N86-16889*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANIMAL STUDIES ON SPACELAB-3
C. Schatte, R. Grindeland, P. Callahan, G. Funk, W. Lencki (Matsco, Valley Forge, Pa.), and W. Berry Jan. 1986 7 p
(NASA-TM-88212; A-86113; NAS 1.15:88212) Avail: NTIS HC A02/MF A01 CSCL 06E

The flight of two squirrel monkeys and 24 rates on Spacelab-3 was the first mission to provide hand-on maintenance on animals in a laboratory environment. With few exceptions, the animals grew and behaved normally, were free of chronic stress, and differed from ground controls only for gravity-dependent parameters. One of the monkeys exhibited symptoms of space sickness similar to those observed in humans, which suggests squirrel monkeys may be good models for studying the space-adaptation syndrome. Among the wide variety of parameters measured in the rats, most notable was the dramatic loss of muscle mass and increased fragility of long bones. Other interesting rat findings were those of suppressed interferon production by spleen cells, defective release of growth hormone by somatotrophs, possible dissociation of circadian pacemakers, changes in hepatic lipid and carbohydrate metabolism, and hypersensitivity of marrow cells to erythopoietin. These results portend a strong role for animals in identifying and elucidating the physiological and anatomical responses of mammals to microgravity. Author

N86-16890*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF 9-HOUR TIME ZONE CHANGES ON FATIGUE AND CIRCADIAN RHYTHMS OF SLEEP/WAKE AND CORE TEMPERATURE
P. H. Gander, G. Myhre, R. C. Graeber, H. T. Andersen, and J. K. Lauber Dec. 1985 38 p refs
(NASA-TM-88197; A-86057; NAS 1.15:88197) Avail: NTIS HC A03/MF A01 CSCL 06S

Physiological and psychological disruptions caused by transmeridian flights may affect the ability of flight crews to meet operational demands. To study these effects, 9 Royal Norwegian Airforces P3-Orion crewmembers flew from Norway to California (-9 hr), and back (+9 hr). Rectal temperature, heart rate and wrist activity were recorded every 2 min, fatigue and mood were rated every 2 hr during the waking day, and logs were kept of sleep times and ratings. Subjects also completed 4 personality inventories. The time-zone shifts produced negative changes in mood which persisted longer after westward flights. Sleep quality (subjective and objective) and duration were slightly disrupted (more after eastward flights). The circadian rhythms of sleep/wake and temperature both completed the 9-hr delay by day 5 in California, although temperature adjusted more slowly. The size of the delay shift was significantly correlated with scores on extraversion and achievement need personality scales. Response to the 9-hr advance were more variable. One subject exhibited a 15-hr delay in his temperature rhythm, and an atypical sleep/nap pattern. On average, the sleep/wake cycle (but not the temperature rhythm), completed the 9-hr advance by the end of the study. Both rhythms adapted more slowly after the eastward flight. Author

N86-16891# Department of Energy, Washington, D. C.
IMPROVED MONOCLONAL ANTIBODIES TO HALODEOXYURIDINE Patent Application
M. Vanderlaan (Lawrence Livermore National Lab., Calif.), F. A. Dolbeare (Lawrence Livermore Lab., Calif.), J. W. Gray (Lawrence Livermore Lab., Calif.), and C. B. Thomas, inventors (to DOE) (Lawrence Livermore Lab., Calif.) Filed 18 Oct. 1983 33 p
(Contract W-7405-eng-48)
(DE85-017764; US-Patent-Appl-SN-542967) Avail: NTIS HC A03/MF A01

The development, method of production, characterization and methods of use of two hybridomas, CldU-1 (ATCC Accession No. HB-8321) and CldU-2 (ATCC Accession No. HB-8320), are described. These secrete IgG1(K) immunoglobulins react with halodeoxyuridine (HdU or halodU) such as bromo, chloro, fluoro and iodo deoxyuridine (BrdU, CldU, FdU and IdU), whether these are free in solution or incorporated into single stranded DNA in whole cells. The antibodies do not react with naturally occurring free nucleic acids or with deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) polymers. These antibodies are suitable for use in enzyme immunoassays for free CldU, FdU, IdU and BrdU and for detecting cells with these nucleotides incorporated into them. The nomoclonal antibodies are useful in the detection of the sensitivity of tumor cells to specific chemotherapeutic agents, in the measurement of the rate of cellular DNA synthesis, in the measurement of the rate of proliferation of normal and malignant cells and in the detection of HPRT deficiency in cells. DOE

N86-16892# Department of Energy, Washington, D. C. Office of Energy Research.
HEALTH AND ENVIRONMENTAL EFFECTS OF COMPLEX CHEMICAL MIXTURES
1985 117 p Preceedings of Conference held in Chicago, Ill., 17 Jun. 1985
(DE85-016336; CONF-8506155) Avail: NTIS HC A06/MF A01

The Office of Health and Environmental Research (OHER) of the Department of Energy supports a broad long-term research program on human health and environmental effects from potential exposure to energy-related complex chemical mixtures. The program seeks basic mechanistic data on the effects of complex mixtures at the cellular, molecular, and whole animal levels to aid in predicting human health effects and seeks ecological data on biological and physical transformations in the mixtures, concentrations of the mixtures in various compartments of the environment, and potential routes for human exposure to these mixtures (e.g., food chain). On June 17 to 18, 1985, OHER held its First Annual Technical Meeting on the Complex Chemical Mixtures Program in Chicago, Ill. The primary purpose of the meeting was to enable principal investigators to report the research status and accomplishments of ongoing complex chemical mixture studies supported by

OHER. To help focus future research directions round table discussions were conducted. DOE

N86-16893# New York Univ., New York. Inst. of Environmental Medicine.
IN VIVO DETECTION, LOCALIZATION AND MEASUREMENT OF RADIONUCLIDES IN MAN: A DETECTION SYSTEM FOR THE LOCALIZATION AND MEASUREMENT OF SMALL AMOUNTS OF PHOTON EMITTERS Final Report
G. R. Laurer 1 Aug. 1985 41 p
(Contract DE-AC02-78EV-04957)
(DE85-017601; DOE/EV-04957/5; COO-4957-5) Avail: NTIS HC A03/MF A01

A new detector has been devised which, by providing a significant increase in geometric counting efficiency, allows a concurrent reduction in the amount of radioactivity needed to produce an image of the deposition site(s) of radionuclides in humans and/or experimental animals. Consisting of four wedge-shaped NaI(Tl) crystals in a unique geometrical arrangement, the crystals themselves function as the collimator generally employed in radionuclide imaging applications. The four crystals, when coupled, become a 4-crystal unit detector; joined so their active faces form the silhouette of a pyramid. The outside, vertically oriented, rectangular faces of each crystal are placed back-to-back with those of adjoining detectors. Thus, small or large arrays of the 4-crystal unit detectors may be assembled. In practice, the array of detectors will be moved in fixed, discrete steps over the source of radiation to be imaged. As a result of its shape, each count obtained from each crystal at each counting position is different, relative to its position above the source. The array of counts obtained in this manner is the raw spatial information. They are used in a system of linear, simultaneous equations which relate the position of the detectors to the counts obtained at each position. The solution of these equations - utilizing the predetermined point-source-response (PSR) function of the crystals - yields a two-dimensional image of the deposition site of the radioactivity. DOE

N86-16894# Societe Nationale Industrielle Aerospatiale, Paris (France).
CHARACTERIZATION OF YAG LASERS FOR OPHTHALMOLOGIC APPLICATIONS [CARACTERISATION DES LASERS YAG POUR L'OPHTALMOLOGIE]
A. P. Josse 1985 5 p In FRENCH Presented at Intern. Seminar on Caracterisation des LASERS YAG pour l'Ophtalmol., Lorient, France, 5-6 Sep. 1985
(SNIAS-852-430-107) Avail: NTIS HC A02/MF A01

The shock waves produced in a water medium by a YAG laser source are measured and visualized. The human eye optical system is simulated by an experimental set-up. A pulsed YAG laser with up to 1 J power is used. The time and space visualizations are based on the variation of the optical refraction index in the water. Time visualization by the Schlieren method allows measuring of the propagation velocity of the shock wave at various distances from the plasma initiation point. Photographs are included. Pressure is evaluated from velocity following the finite difference method. Author (ESA)

N86-16895# Health Effects Research Lab., Research Triangle Park, N. C.
BIOLOGICAL EFFECTS OF ELECTRIC FIELDS
R. D. Phillips Aug. 1985 31 p
(PB85-243467; EPA-600/D-85-174) Avail: NTIS HC A03/MF A01 CSCL 05R

Research concerned with the biological consequences of exposure to extremely-low-frequency radiation is reviewed. Epidemiological and clinicial studies and an examination of results of studies using experimental animals are summarized. Current concepts on possible mechanisms and future directions of research are presented. GRA

N86-16896# Resources for the Future, Inc., Washington, D. C.
AMBIENT OZONE AND HUMAN HEALTH: AN EPIDEMIOLOGICAL ANALYSIS, VOLUME 1 Final Report
P. R. Portney and J. Mullahy Aug. 1985 327 p refs
(Contract EPA-68-02-3583)
(PB85-245181; EPA-450/5-85-003A-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 06E

The relationship between ozone and human health benefits was analyzed. The benefits for improved human health associated with possible alternative air quality standards for ozone are identified. GRA

N86-16641# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MODEL EVALUTION OF SPINAL INJURY LIKELIHOOD FOR VARIOUS EJECTION SYSTEM PARAMATER VARIATIONS
Eberhardt Privitzer *In* Shock and Vibration Information Center The Shock and Vibration Bulletin 55, Part 3 Jun. 1985 p 99-115 refs (For primary document see N86-16632 07-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 06S

N86-16882# Joint Publications Research Service, Arlington, Va.
ADVANCES IN NERVE CELL RESEARCH
Ye. Chazov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UB-85-025) 10 Dec. 1985 p 2-4 Transl. into ENGLISH from Pravda (Moscow), 16 Aug. 1985 p 6 (For primary document see N86-16881 07-51)
Avail: NTIS HC A05/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-16897# Air Force Academy, Colo.
PROCEEDINGS OF THE AIR FORCE CONFERENCE ON TECHNOLOGY IN TRAINING AND EDUCATION (TITE)
Apr. 1985 596 p Conference held in Colorado Springs, Colo., 15-19 April 1985
(AD-A157829) Avail: NTIS HC A25/MF A01 CSCL 05/9

Although the field of Artificial Intelligence has the potent enhance the Air Force's readiness and ability to respond to situations, too few people really known what it is, or what the Air Force. In addition, most educational programs in AI towards the PhD student and are very theoretical. At the Air Institute of Technology, we have developed an engineering in AI at the masters of science level. This program is one masters degree programs available. In addition this represent first programs to extract the engineering techniques from Artificial Intelligence. In this report, the above program described along with our philosophy and approach to teaching. GRA

N86-16898# Illinois Univ., Urbana. Computer-based Education Research Lab.
APPLICATION OF COMPONENT SCORING TO A COMPLICATED COGNITIVE DOMAIN
K. K. Tatsuoka and K. Yamamoto 15 May 1985 29 p
(Contract N00014-82-K-0604)
(AD-A157897; AD-E900470; CERL-85-2-ONR) Avail: NTIS HC A03/MF A01 CSCL 05/10

The recent development of cognitive psychology and science suggests that the lack of understanding of important structural relations between the entities in a problem-solving domain causes difficulties in learning. This study proposes a new scoring method by which the structural relations as well a processes used in subcomponents of the knowledge structure are taken into account when determining the scores. By so doing, a score of I derived by wrong reasons will be eliminated and patterns of zeros and ones will contain information closely associated with student's cognitive processes. The procedure is illustrated with basic electricity problems. GRA

N86-16899# Illinois Univ., Urbana. Computer-based Education Research Lab.
BUG DISTRIBUTION AND PATTERN CLASSIFICATION
K. K. Tatsuoka and M. M. Tatsuoka 15 Jul. 1985 34 p
(Contract N00014-82-K-0604)
(AD-A157898; AD-E900470; CERL-85-3-ONR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A model (called rule space) which permits measuring cognitive skill acquisition, diagnosing cognitive errors, detecting the weaknesses and strengths of knowledge possessed by individuals was introduced earlier. This study further discusses the theoretical foundation of the model by introducing Bug Distribution and hypothesis testing (Bayes' decision rules for minimum errors) for classifying and individual into his/her most plausible latent state of knowledge. The model is illustrated with the domain of fraction arithmetic and compared with the results obtained from a conventional Artificial Intelligence approach. GRA

N86-16900# Defence Research Information Centre, Orpington (England).
VARIATIONS IN STATE OF VIGILANCE DURING CONTINUOUS OPERATIONS AT A COMMAND POST
J. Fourcade, A. Buguet, R. Bugat, and C. Raphel Jul. 1985 36 p refs Transl. into ENGLISH from AGARD Conference Proceedings 16 p Proceedings of Conference No. 338, Sustained Intensive Air Operations: Physiological and Performance Aspects
(DRIC-T-7503; BR96591) Avail: NTIS HC A03/MF A01

The changes in mental and decision making abilities in personnel working at division command posts, during four maneuvers which took place continuously over several days were studied to appraise the problems which arise during continuous operations, and to give advice to commanders on the organization of the waking - sleeping rhythm at command posts and on arrangements which can be encouraged in order to facilitate the work and reduce mental load factors. Physiological, biochemical, and psychological implications of continuous operations are discussed. Author (ESA)

N86-16884# Joint Publications Research Service, Arlington, Va.
PEPTIDES AND MEMORY
L. Ivchenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-85-025) 10 Dec. 1985 p 31-34 Transl. into ENGLISH from Izvestiya (Moscow, USSR), 1 Aug. 1985 p 8 (For primary document see N86-16881 07-51)
Avail: NTIS HC A05/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N86-16901*# Massachusetts Inst. of Tech., Cambridge. Man Machine Systems Lab.
EFFECT OF TIME SPAN AND TASK LOAD ON PILOT MENTAL WORKLOAD
S. L. Berg and T. B. Sheridan Jan. 1986 152 p refs
(Grant NAG2-227)
(NASA-CR-177388; NAS 1.26:177388) Avail: NTIS HC A08/MF A01 CSCL 05H

Two sets of simulations designed to examine how a pilot's mental workload is affected by continuous manual-control activity versus discrete mental tasks that included the length of time between receiving an assignment and executing it are described. The first experiment evaluated two types of measures: objective performance indicators and subjective ratings. Subjective ratings for the two missions were different, but the objective performance measures were similar. In the second experiments, workload levels were increased and a second performance measure was taken. Mental workload had no influence on either performance-based workload measure. Subjective ratings discriminated among the scenarios and correlated with performance measures for high-workload flights. The number of mental tasks performed did not influence error rates, although high manual workloads did increase errors. E.A.K.

N86-16902*# GARD, Inc., Niles, Ill.
CATALYTIC DISTILLATION WATER RECOVERY SUBSYSTEM
Pranas Budininkas and Firooz Rasouli Sep. 1985 104 p
(Contract NAS2-11687)
(NASA-CR-177382; NAS 1.26:177382) Avail: NTIS HC A06/MF A01 CSCL 06K

An integrated engineering breadboard subsystem for the recovery of potable water from untreated urine based on the vapor phase catalytic ammonia removal was designed, fabricated and tested. Unlike other evaporative methods, this process catalytically oxidizes ammonia and volatile hydrocarbons vaporizing with water to innocuous products; therefore, no pretreatment of urine is required. Since the subsystem is fabricated from commercially available components, its volume, weight and power requirements are not optimized; however, it is suitable for zero-g operation. The testing program consists of parametric tests, one month of daily tests and a continuous test of 168 hours duration. The recovered water is clear, odorless, low in ammonia and organic carbon, and requires only an adjustment of its pH to meet potable water standards. The obtained data indicate that the vapor phase catalytic ammonia removal process, if further developed, would also be competitive with other water recovery systems in weight, volume and power requirements. Author

N86-16903*# Economics Lab., Inc., St. Paul, Minn.
A STUDY TO DEFINE A SET OF REQUIREMENTS FOR CLEANSING AGENTS FOR USE IN THE SPACE STATION WHOLE BODY SHOWER Final Report
29 Oct. 1985 95 p
(Contract NAS9-17428)
(NASA-CR-171910; NAS 1.26:171910) Avail: NTIS HC A05/MF A01 CSCL 06K

The objective of this research is to define a set of requirements for a whole body cleansing agent to be used in the Space Station Whole Body Shower System. In addition, cleansing agent candidates are to be identified that are likely to satisfy requirements defined in the first part of the study. It is understood that the main reason for having a Whole Body Shower is to satisfy the physiological, psychological and social needs of the crew throughout the duration of duty in the Space Station. The cleansing agent must also be compatible with the vortex water/gas separator and the water reclamation system. To accomplish these goals the study was divided into six tasks. Author

N86-16904# Naval Postgraduate School, Monterey, Calif.
OPERATIONS RESEARCH TECHNIQUES FOR HUMAN FACTORS ENGINEERS M.S. Thesis
J. H. Lind Jun. 1985 193 p
(AD-A159384) Avail: NTIS HC A09/MF A01 CSCL 05/8

In this thesis a variety of operations research techniques and models that are applicable to human factors engineering problems are identified and classified according to the functions or purposes for which they are useful. Several of these techniques are described in sufficient detail for a human factors engineer to determine if they are applicable to a problem of interest. Uses for techniques are illustrated in military-related human factors settings, primarily related to the Navy's antiair warfare mission. References are provided for additional information on each technique.
Author (GRA)

N86-16905# Research Inst. of National Defence, Stockholm (Sweden). Dept. 5.
OPERATOR ENVIRONMENT IN THE NINETIES
Hans Marmolin and Staffan Loef Apr. 1985 25 p refs In SWEDISH; ENGLISH summary
(FOA-A-50002-H2; ISSN-0281-0239) Avail: NTIS HC A02/MF A01

A program of research and development in man-information systems is outlined. Human factors engineering, display, dialog,

and design of decision aid systems from a man-machine approach are discussed. A program to ensure knowledge transfer and an effective dialog with possible users was created. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N86-16906*# Sequoia Systems, Inc., Marlborough, Mass.
CARE 3, VERSION 4 ENHANCEMENTS
L. A. Bryant and J. J. Stiffler Nov. 1985 141 p refs
(Contract NAS1-17476)
(NASA-CR-177963; NAS 1.26:177963) Avail: NTIS HC A07/MF A01 CSCL 12A

The enhancements and error corrections to CARE III Version 4 are listed. All changes to Version 4 with the exception of the internal redundancy model were implemented in Version 5. Version 4 is the first public release version for execution on the CDC Cyber 170 series computers. Version 5 is the second release version and it is written in ANSI standard FORTRAN 77 for execution on the DEC VAX 11/700 series computers and many others. Author

N86-16907*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SEPARABLE TWO-DIMENSIONAL DISCRETE HARTLEY TRANSFORM
Andrew B. Watson and Allen Poirson (Stanford Univ., Palo Alto, Calif.) Dec. 1985 14 p refs
(NASA-TM-88203; A-86071; NAS 1.15:88203) Avail: NTIS HC A02/MF A01 CSCL 12A

Bracewell has proposed the Discrete Hartley Transform (DHT) as a substitute for the Discrete Fourier Transform (DFT), particularly as a means of convolution. Here, it is shown that the most natural extension of the DHT to two dimensions fails to be separate in the two dimensions, and is therefore inefficient. An alternative separable form is considered, corresponding convolution theorem is derived. That the DHT is unlikely to provide faster convolution than the DFT is also discussed. Author

N86-16908# Argonne National Lab., Ill.
RESEARCH IN MATHEMATICS AND COMPUTER SCIENCES AT ARGONNE, APRIL 1 1984 - MARCH 31, 1985
G. W. Pieper 1985 50 p
(Contract W-31-109-eng-38)
(DE85-013852; ANL-85-24) Avail: NTIS HC A03/MF A01

The research activities in the Mathematics and Computer Science Division at Argonne National Laboratory for the period April 1, 1984, through March 31, 1985 are reviewed. Various projects carried out in four major areas of research: applied analysis, computational mathematics, software engineering, and advanced computing are discussed. Information on section staff, visitors, workshops, and seminars is given. DOE

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N86-16909 Cincinnati Univ., Ohio.
ON A COMPUTER VISION SYSTEM FOR MODELING OF SOLID OBJECTS FROM MULTIPLE 2-D IMAGE DATA Ph.D. Thesis
Chia Yung Han 1985 185 p
Avail: Univ. Microfilms Order No. DA8518129

To accommodate the lack of strong visual features in the image obtained without the constraints of planar surfaces and controlled lighting conditions, 3-D image analysis and 3-D model generation require a complex vision system model with the following capabilities: (1) to be able to select the areas of focus; (2) to have a robust segmentation methods to extract meaningful areas and their properties; (3) to have a geometrical modeling based on physics of image formation process and geometry of the camera, object and lighting sources, to constrain the relationship among data from multiple views; and (4) to have a smart or intelligent brain that has a knowledge representation to reduce the search space and to select most representative features that characterize efficiently a class of objects and to perform interpretation, geometrical reasoning, prediction and planning for subsequent views to be taken in order to incrementally refine the object model. A computer vision system model that embodies all above requirements is proposed. A robust image segmentation scheme and a 3-D model reconstruction scheme that satisfy both the second and the third requirements are implemented and presented. Dissert. Abstr.

N86-16910 Ohio State Univ., Columbus.
A MODULAR MICROPROCESSOR-BASED DATA ACQUISITION SYSTEM FOR COMPUTERIZED 3-D MOTION ANALYSIS Ph.D. Thesis
Michael Lee French 1985 213 p
Avail: Univ. Microfilms Order No. DA8518941

A camera computer interface system was developed for the purpose of obtaining three dimensional motion information from moving targets. The analysis of biomechanical kinematics is the primary intent of the system, human gait analysis in particular. The system was designed in modular form in that a single interface module is capable of interfacing a raster scan camera with a PDP-11/34 host computer. Each interface module is capable of accepting camera signals from one of two types of cameras. A total of five camera interface modules were developed, each incorporating an MC6800 microprocessor, and 64K workd dynamic RAM buffer. After data collection, the obtained coordinate and force information is stored on a flopply disk for subsequent processing. The results of this processing are plots of joint angles such as ankle angle and knee angle as well as plots of forces and torques at these joints. Dissert. Abstr.

N86-16911 Yale Univ., New Haven, Conn.
CHARGE-COUPLED ANALOG COMPUTER ELEMENTS AND THEIR APPLICATION TO SMART IMAGE SENSORS Ph.D. Thesis
Eric Roy Fossum 1985 352 p
Avail: Univ. Microfilms Order No. DA8509807

An analog processor based on the manipulation of discrete charge packets in a semiconductor is advocated. Such a processor shows promise for high density focal plane computing. The work focuses on the basic building blocks of the charge coupled computer, a charge packet differencer/replicator and a charge packet magnitude comparator. The former is implemented in a novel circuit in an inherently linear and compact way through the use of three-dimensional charge coupling. Also investigated was the bistable metal/tunnel-oxide/semiconductor (MTOS) junction. The application of this device as a charge packet magnitude comparator was explored by utilizing its hot electron impact

ionization internal positive feedback mechanism. The control circuitry integrated with the MTOS junction provided an oppportunity to investigate the internal charging and disharging currents of the thin oxide capacitor. Dissert. Abstr.

N86-16912 Johns Hopkins Univ., Baltimore, Md.
AN INSTRUMENT FOR EVALUATING THE USE OF SPEECH IN COMPUTER COMMUNICATION Ph.D. Thesis
Janan Arif Al-Awar 1985 227 p
Avail: Univ. Microfilms Order No. DA8518472

The usefulness of voice Input/Output (I/O) for computer systems can be determined through a set of defining characteristics. These characteristics can be divided into two main groups: (1) those conditions necessary for the viability of any voice communication system, and (2) additional features that may not be vital for the system, but if implemented, would greatly enhance its usability. A paper and pencil instrument for evaluating the usefulness of speech in user-computer communication was developed. The items in the instrument were obtained by identifying features that are considered imperative and/or desirable in either a voice input or voice output system. These features were assembled in three groups: items related to the users, items related to the tasks, and items related to the environment in which the system would be present. They were validated by an analysis of their contents, an empirical content validation study, and field observation studies of two operational voice systems. Finally, the effects of voice feedback on performance were investigated in a laboratory simulation experiment. Dissert. Abstr.

N86-16913*# College of William and Mary, Williamsburg, Va.
THE MYSTRO SYSTEM: A COMPREHENSIVE TRANSLATOR TOOLKIT Final Report
W. Robert Collins and Robert E. Noonan Jun. 1985 37 p refs
(Grant NsG-1435)
(NASA-CR-176350; NAS 1.26:176350) Avail: NTIS HC A03/MF A01 CSCL 09B

Mystro is a system that facilities the construction of compilers, assemblers, code generators, query interpretors, and similar programs. It provides features to encourage the use of iterative enhancement. Mystro was developed in response to the needs of NASA Langley Research Center (LaRC) and enjoys a number of advantages over similar systems. There are other programs available that can be used in building translators. These typically build parser tables, usually supply the source of a parser and parts of a lexical analyzer, but provide little or no aid for code generation. In general, only the front end of the compiler is addressed. Mystro, on the other hand, emphasizes tools for both ends of a compiler. G.L.C.

N86-16914*# System Development Corp., Hampton, Va.
MAGNETIC TAPE USER GUIDE
Agnes B. Evans and Lucia L. Lee Sep. 1985 57 p
(Contract NAS1-17300)
(NASA-CR-177993; NAS 1.26:177993) Avail: NTIS HC A04/MF A01 CSCL 09B

This User Guide provides a general introduction to the structure, use, and handling of magnetic tapes at Langley Research Center (LaRC). The topics covered are tape terminology, physical characteristics, error prevention and detection, and creating, using, and maintaining tapes. Supplementary documentation is referenced where it might be helpful. The documentation is included for the tape utility programs, BLOCK, UNBLOCK, and TAPEDMP, which are available at the Central Scientific Computing Complex at LaRC. Author

N86-16915# Stanford Univ., Calif.
DATA BASE MANAGEMENT
H. Solomon and E. H. Weinberg 31 Jul. 1985 307 p Proceedings of a conference held in Monterey, Calif., 1-2 Nov. 1984
(Contract N00014-76-C-0475)
(AD-A158285) Avail: NTIS HC A14/MF A01 CSCL 09/2

Stanford University and the Navy Center for International Science and Technology (NCIST) and Office of Naval Research Univ, loated at the U.S. Naval Postgraduate School (NPGS) in Monterey jointly sponsored a Database Management Conference on November 1-2, 1984. Eleven speakers were invited to give talks over the two days to audiences numbering 25 to 35 workers in the field. These speakers covered a wide spectrum of specialties in database management. Topics were: Database Organization for statistical Data Analysis; Automating the study of Causal Relationships ... Large Time-Oriented Clinical Databases: The RX Project; CODA: A Concept Organization and Development Aide for the Research Environment; Information Management for Distributed Scientific Data; Put the Information in the Database Not the Program; Relevance of Machine Learning; Managing the Data Analysis Process; Remarks on Parallel Computer Architecture and Information Retrieval; Linking Science, Technology, and Economics Data; The World Brain Today: Scientographic Databases. What are they, How are the created and What are they used for? Beyond Storage Retrieval. Author

N86-16916# Ohio State Univ., Columbus.
A LISP MACHINE FACILITY FOR EXPERT SYSTEMS RESEARCH Final Report, 1 Aug. 1983 - 31 Jul. 1984
B. Chandrasekaran Aug. 1984 73 p
(Grant AF-AFOSR-0300-83)
(AD-A159126; AFOSR-85-0636TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

During the year, progress was made in a number of directions: (1) A better understanding of different types of problem solving that underlie expert reasoning was obtained; (2) Advances in representing design knowledge as plans in design specialists were made; (3) CSRL, the language for diagnostic expert system building that was designed in our Laboratory, was applied to the implementation of a diagnostic system for the fuel system of an automobile and directions for new constructs for the language were obtained; (4) A representation for functional understanding of how a device works was obtained, and methods of automatically generating diagnostic expert systems from this representation of a device were also obtained; (5) An analysis of how techniques and tasks can be matched in expert design was undertaken. Author (GRA)

N86-16917# Naval Postgraduate School, Monterey, Calif.
DESIGN AND IMPLEMENTATION OF A PERSONNEL DATABASE M.S. Thesis
B. Buyukoner and Y. Ozin Jun. 1985 157 p
(AD-A159388) Avail: NTIS HC A08/MF A01 CSCL 09/2

This thesis deals with the design considerations for a personnel database system. It introduces the important concepts related to the analysis and design phases of a database system. Two types of data models, namely conceptual and implementation models, are described, particularly concentrating on the Semantic Data Model (SDM) for conceptual and the Relational Data Model for implementation. The Semantic Data Model is used to indicate the entities and relationships between those entities for the Personnel Database. After the completion of this process, the SDM design is converted into a corresponding relational database which is implemented using the ORACLE Database Management System. GRA

N86-16918# Lawrence Livermore National Lab., Calif.
DATA ACQUISITION WITH REAL-TIME PLOTS
G. Koide 9 Aug. 1985 12 p
(Contract W-7405-eng-48)
(DE85-017326; UCID-20494) Avail: NTIS HC A02/MF A01

A data acquisition system using an LST-11/23 microcomputer has 32 analog-to-digital channels of which the first four are available for real-time plots. The software is menu driven allowing a user to easily step through an experimental test. To calibrate each transdcer, one of three options must be selected. They are shunt calibration, calibration with known inputs, and manually entering the offset and scale factor directly. After a test, post-experimental plots may be made. Any channel can be plotted against time or any other channel. Furthermore, more than one curve, up to a

maximum of four, can be drawn on any set of grids. Telescopic views of any portion of data are also possible. DOE

N86-16919# George Washington Univ., Washington, D.C. Inst. for Information Science and Technology.
STANDARD GRAPHICS AND MODELLING CLASSES OF THE IMAGYS LANGUAGE
J. B. H. Acquah Nov. 1984 20 p
(Contract DE-AS05-83ER-13122)
(DE85-013383; DOE/ER-13122/3) Avail: NTIS HC A02/MF A01

The base language which is partly described in GWU11ST84-50 provides only the essential facilities for constructing new classes of objects, and operators or implementing the dynamic processes. The detailed graphics facilities are built on top of these basic features. Some of the modeling and graphics classes defined as a starting point for writing interactive graphics programs are described. DOE

N86-16920# European Space Agency, Paris (France).
REASONS FOR NUMERICAL ERRORS IN DIGITAL COMPUTERS
Ulrich Heidemann Jun. 1984 55 p refs Transl. into ENGLISH of "Ursachen fuer numerische Fehler auf Digitalrechnern" rept. DFVLR-Mitt-83-13 DFVLR, Brunswick, West Germany, 1983 Original language document was announced as N84-16839
(ESA-TT-840; DFVLR-Mitt-83-13) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 22

The execution of elementary mathematical operations on a digital computer and the errors arising using a well defined type of computer because basic mathematical laws may not be valid on digital computers, are outlined. Tools for estimating the effect of these errors on the final results are presented. Author (ESA)

N86-16921# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
EXPERIENCE OF CRAY-1
Bertil Brusmark and Anders Gustavsson Jun. 1985 73 p refs In SWEDISH; ENGLISH summary
(FOA-C-30392-E1; ISSN-0347-3708) Avail: NTIS HC A04/MF A01; Research Institute of National Defence, Stockholm KR 50

Architecture and use of the Cray-1 computer for scalar and vector calculus are described. The high operating capacity is obtained with the use of special vector-registers and a function-oriented hardware. There are separate registers and function units for scalar and vector operators. Vectors are processed by groups of 64. The storage devices allow a cycle period of 12.5 nsec. The capacity for matrix multiplication is illustrated by graphs. The applied software was selected from a synthetic aperture radar (SAR) processing package. Author (ESA)

N86-16922# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
OPTICAL SUPERCOMPUTERS AND MAGIC MIRRORS
Per Lindberg Jun. 1985 37 p refs In SWEDISH; ENGLISH summary Presented at 13th International Committee for Optics in Modern Science and Technology, Sapporo, Japan, 20-24 Aug. 1984
(FOA-C-30393-E1; ISSN-0347-3708) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm KR 50

Optical computing, imaging techniques, image processing, astronomical telescopes, measuring sensors, optical manufacturing, and human vision are discussed. Optical supercomputers will be faster and less susceptible to interference than electronic ones. Optical manufacturing and testing have a surprisingly good precision thanks to progress in ceramics and laser measuring devices. Author (ESA)

N86-16923# National Bureau of Standards, Gaithersburg, Md.
REFERENCE MODEL FOR DBMS (DATABASE MANAGEMENT SYSTEM) STANDARDIZATION
D. K. Jefferson and E. N. Fong May 1985 79 p
(PB85-225217; NBSIR-85/3173) Avail: NTIS HC A05/MF A01 CSCL 09B

Reference Model (RM) for database management system (DBMS) standardization. A Reference Model is a conceptual framework whose purpose is to divide standardization work into manageable pieces and to show at a general level how these pieces are related with each other. The proposed RM comprises a data mapping control system (DMCS) that retrieves and stores application data, application schemas, and data dictionary schemas. This DMCS is bounded by two interfaces: the data language (DL) interface which defines the services offered by the DMCS to various data management tools (DMT), and the internal data language (i-DL) interface which defines the services required by the DMCS from the host operating system. Two candidates for standardization: the DL and the -DL are proposed. GRA

N86-16924# Joint Publications Research Service, Arlington, Va.
USSR REPORT: CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY
28 Aug. 1985 79 p Transl. into ENGLISH from various Russian articles
(JPRS-UCC-85-005) Avail: NTIS HC A05

Numerous topics related to cybernetics, computers, and data processing technology are discussed. Self-testing and redundancy in very large memory microcircuits, the microfilming of scientific information, software implementation of a dialogue information retrieval system, and parallel searching in a distributed database are among the topics covered. For individual titles, see N86-16925 through N86-16933.

N86-16925# Joint Publications Research Service, Arlington, Va.
SELF-TESTING AND REDUNDANCY IN VERY LARGE MEMORY MICROCIRCUITS **c33**
A. S. Berezin, Ye. M. Onishchenko, and S. V. Sushko *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 20 Transl. into ENGLISH from Mikroelektronika (Moscow, USSR), no. 2, Mar.-Apr. 1985 p 99-102 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

Simplification of testing of very large scale integration (VLSI) random access memory (RAM) chips can be achieved by partially transferring the functions of testing to the chips themselves, i.e., self-testing. This allows simultaneous testing of all chips on a board. A VLSI memory chip with self-testing and on-chip redundancy is analyzed. A self-test is performed each time power is turned on and any defective locations are recorded in special additional memory locations on the chip. A test of length 4 N, where N is the number of locations in the accumulator, sufficient to determine failures of entire rows or columns, as well as locations which always contain a one or zero regardless of what has been recorded in them. Even a simple test of this type is quite effective. The use of tests revealing other types of errors makes power-on testing longer, reducing available machine time. Author

N86-16926# Joint Publications Research Service, Arlington, Va.
DESIGN OF MEMORY TESTS ON THE BASIS OF ANALYSIS OF SEQUENCES OF FUNCTIONAL OPERATORS **c33**
A. V. Grinshteyn and G. Kh. Novik *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 20-21 Transl. into ENGLISH from Mikroelektronika (Moscow, USSR), no. 2, Mar.-Apr. 1985 p 103-109 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

A method involving analysis of sequences of functional operators is used to derive a test which detect any combination of the subclass of defects in random access memory resulting from the mutual influence of arbitrary pairs of memory locations. The method is used to produce a minimal march requiring 30N operations. The method itself and the properties and types of sequences of functional operators can be used for more complex memory defect models as well. The properties of the sequences

of functional operators established allow estimation of the completeness of the testing achieved by existing tests. Author

N86-16927# Joint Publications Research Service, Arlington, Va.
NOISE CHARACTERISTICS OF STROBOSCOPIC CONVERTERS BASED ON GALLIUM ARSENIDE INTEGRATED MICROCIRCUITS **c33**
V. I. Staroselskiy *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 22 Transl. into ENGLISH from Mikroelektronika (Moscow, USSR), no. 2, Mar.-Apr. 1985 p 162-168 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

The characteristics of strobe converters can be improved by making the input device as a gallium-arsenide-based integrated microcircuit, which allows some decrease in converter internal noise, by the use of a four-diode bridge circuit microwave band mixer, by the use of special accumulating condenser discharge circuits, by implementation of full accumulating condenser charging in the microwave band, by selection of the dimensions of microcircuit components, and by the achievement of extremely low leakage currents. An integrated microcircuit for the input device of a strobe converter is described. Sources and mechanisms of internal noise in the converter are analyzed and possibilities for minimizing the noise by optimal selection of amplifier-integrater bandwidth are discussed. Flicker noise in the output repeater is the major source of noise and can be decreased by full charging of the accumulating condenser during the strobe cycle, optimizing the bandwidth of the output amplifier and optimizing the topology of the field-effect transistor. Decreasing the integration time of the expanded pulse with the output amplifier can practically neutralize breakup and flicker noise of closed mixer diodes. Author

N86-16928# Joint Publications Research Service, Arlington, Va.
A NEW GENERATION OF ASPID INFORMATION RETRIEVAL SYSTEMS **c82**
G. K. Stolyarov, R. B. Grigyanets, and K. P. Kvachuk *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 25-27 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (USSR), no. 2, Mar-Apr. 1985 p 126.124 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

The Automated Keyword Information Retrieval System (ASPID) is the Soviets' continually developing family of information management software. It operates on large-scale, mini, and micro computers and is the largest system link for processing scientific technical, design, and organizational management information. Two new members of the ASPID family, ASPID-5/YeS and ASPID-7/SM, address the need for local and locally-distributed problem oriented information systems. Research at the laboratory for software systems at the Institute of Mathematics Academy of Sciences of the Belorussian SSR (AN BSSR) was completed in June 1984 for two new interactive document data retrieval systems, ASPID-5/YeS which runs on ES computers and ASPID-7/SM which runs on SM computers. ASPID-5/YeS was designed to create interactive document information retrieval systems on the ES computers and utilizes the newest domestic and foreign achievements in information system software. The system provides input, data base formatting, integrated storage, and keyword search and retrieval of free-form text as well as highly structured information. A number of the system's features are listed. Author

N86-16929# Joint Publications Research Service, Arlington, Va.
SEPARATE COMPILATION MECHANISM IN ADA LANGUAGE PROGRAMMING SYSTEM **c61**
A. B. Gorubov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 35 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 1, Jan.-Feb. 1985 p 16-25 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

The problem of separate compilation for the ADA language is studied, ignoring generic units. This reduces the problem to the performance of three tasks: (1) control of compilation sequence; (2) support of semantic analysis of connections between compilation units; and (3) use of compilation units from other program libraries. A method is suggested for considering connections between compilation units allowing the transition to be made from connections between names in compilation units to relationships among compilation units. The relationships are used to introduce the concept of recompile tactics, demonstrating that recompile sequence control can be reduced to the application of two such tactics. A method is suggested for using units from other program libraries based on access to them by reading, avoiding duplication of intermediate representation of compilation units in the library and transforming the quadratic variation of information volume concerning relationships among units in program libraries to a linear variation as a function of the number of such units. The mechanism of separate compilation described here is based on the use of libraries of intermediate tree-form representations of compilation units, divided by library files into relatively closely related internal and relatively weakly related external library segments. Author

N86-16930# Joint Publications Research Service, Arlington, Va.
PARALLEL SEARCH IN A DISTRIBUTED DATABASE **c82**
V. G. Kerbel *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 41 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 1, Jan-Feb. 1985 p 63-73 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

A study is made of parallel search in a homogeneous MIMD network assuming that the time required to transmit a request from machine to machine is negligible in comparison to the time required to process the request by each machine. Parallel data processing is studied as a function of the nature of data distribution among machines in the network and the rules of servicing of requests in the computer system. The effectiveness of parallel search rules in the distributed database is studied as a function of the time required to process a set of requests, the completeness of the database, processing of requests where data are duplicated, time required to process an individual request as the system services a flow of requests and real-time servicing of a flow of requests by the system. The results of the work confirm the hypothesis that it is efficient to perform group servicing parallel data search when the load on the system is low. As the system becomes saturated with request it is more effective to utilize pipeline servicing or pseudosequential search. Processing of a request in a single machine, then in the entire system, is justified only if the probability of finding the data in a single machine is known. The increase in this probability achieved by duplicating data does not decrease the time required to process a set of requests. Author

N86-16931# Joint Publications Research Service, Arlington, Va.
ADAPTATION OF STOCHASTIC SEARCH METHODS IMPLEMENTED IN A HOMOGENEOUS COMPUTING ENVIRONMENT UNDER CONDITIONS OF UNCERTAINTY **c82**
N. N. Volk, V. O. Groppen, and E. A. Trakhtengerts *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 45-46 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 5, Sep.-Oct. 1984 p 83-91 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

A study is made of the effectiveness of implementing the Monte Carlo method in a homogeneous computing environment with a common memory field, having m processor elements and v control devices. Each can control all processor elements. Problems which can be reduced to the search for a certain quantity z calculated on the basis of a continuous function F(x) defined over an interval (a,b) are studied. It is assumed that quantity z can be defined on the basis of quantities Zi computed by the same method using the same function F(x), defined in the interval (ai,bi); i = 1,2,...v. Adaptation is performed by redistribution of processor elements among branches during the course of search as information on the problem being solved is accumulated. An

ES-1020 OS 4.1 PL/1 simulation model was used to study the proposed method. Author

N86-16932# Joint Publications Research Service, Arlington, Va.
ONE SOFTWARE IMPLEMENTATION OF A DIALOGUE INFORMATION RETRIEVAL SYSTEM c82
B. Ya. Kavalerchik, F. V. Birger, and K. K. Loginov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 51 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

Many automated management systems, especially those created long ago, no means were provided for one-line data retrieval. One possible version of the design of a software dialogue information retrieval system using a YeS-7920 display is described. The basis of the software is a control program intended to allow multiple users to access the database of an automated management system simultaneously while protecting data integrity, allowing for easy error recovery and consuming minimum computer resources. Software includes a query program, dialogue controller, error handler and file handler. Full screen formatted output is supported. Dialogue information retrieval systems using the software structure suggested have been developed for several automated management systems and are in use at a number of computer centers. Author

N86-16933# Joint Publications Research Service, Arlington, Va.
MICROFILMING OF SCIENTIFIC AND TECHNICAL INFORMATION SOURCE DOCUMENTS WITH FEW COLORS c82
L. I. Brodolin, A. Z. Kan, S. I. Kuznetsova, and I. I. Marshak *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 52 Transl. into ENGLISH from Nauchno-Tekhnicheskaya Informatsiya Seriya I. Organizatsiya i Metodika Informatsionnoy Raboty (Moscow, USSR), no. 3, Mar. 1985 p 27-31 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

A study is made of the capabilities of monochrome microfilm apparatus for microfilming documents in which color is used to accent areas of text or diagrams, but in which precise reproduction of color is not essential. The quantitative characteristics of such originals passing through the microfilming service of the All-Union Institute of Scientific and Technical Information are described. Percentages of documents requiring additional processing to yield satisfactory microfilms in 50,000 pages of original documents are as follows: 1.1% originals with few colors, 0.4% full color originals, 0.9% originals in which color was highly significant. The use of color filters and exposure adjustment cannot always reproduce the information satisfactorily. Intermediate electrophotographic copying can be used to avoid information loss, but requires additional consumption of paper and copying equipment. The most flexible and promising means of correction of images is digital image processing, which will require obtaining the appropriate equipment from other organizations. Author

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-16934 North Carolina State Univ., Raleigh.
FOUNDATION TECHNIQUES FOR THE DEVELOPMENT OF A COMPUTER-AIDED ENGINEERING SYSTEM FOR AEROSPACE VEHICLES Ph.D. Thesis
Alan Wade Wilhite 1985 166 p
Avail: Univ. Microfilms Order No. DA8518287

Techniques were developed to support the construction of a computer-aided engineering system for aerospace vehicle analysis and design based on the analysis of past approaches to engineering integration and utilization of commercial database management systems. These techniques were bundled together to form a single system architecture. The system architecture consists of the engineering programs, a user interface for managing the system, a catalog system for maintaining data about the programs, data, and users, individual work areas for each engineer, and a global database that is used as a repository of all engineering data created for central use. A relational information system was developed for this system, and two utilities were developed for interactively editing the database and communicating data between the analysis programs. A sample problem is included to illustrate the system. Dissert. Abstr.

N86-16935 Brigham Young Univ., Provo, Utah.
HIGH PERFORMANCE INTERACTIVE GRAPHICS: ALLIANCE OF SOFTWARE WITH HARDWARE Ph.D. Thesis
Donald Ray Jones 1985 234 p
Avail: Univ. Microfilms Order No. DA8517511

The design and development of the program Dyna-MOVIE.BYU is described. DYNA-MOVIE.BYU is a unique blend of software (MOVIE.BYU) and hardware (Evans & Sutherland PS330) which provides a highly interactive program. Instantaneous geometric and viewing transformations allow for real-time, dynamic, calligraphic (line drawing) display of mathematical models. The data structure is presented specifically for the PS330, but may be generalized for implementation on other high performance devices. The associated function net programs which support the data structure from the hardware design is also described. The Watkins algorithm has been modified for the display of color by parts and color blended vectors. Animated sequences can be produced in either 3-D wire frame representation or with the hidden surfaces removed. Because, the PS330 is a calligraphic display device, the final picture can be saved in a MOVIE.BYU format file. This allows the user to choose a number of continuous-tone raster devices on which the model may be rendered. Dissert. Abstr.

N86-16936 Rice Univ., Houston, Tex.
A SINGLE INTERMEDIATE LANGUAGE FOR PROGRAMMING ENVIRONMENTS Ph.D. Thesis
Michael Alan Caplinger 1985 204 p
Avail: Univ. Microfilms Order No. DA8517183

Programming by the traditional methods of text editing and batch compilation is no longer necessary. The advent of the personal workstation and bitmap graphics allows us to construct integrated programming environments, which actively aid the programmer in viewing, creating, and debugging programs. But despite many attempts to build such environments for the widely used Algol family of languages, none is in production use today. Yggdrasil is an attempt to answer the question of how to build an effective IPE for Algol-like languages. It consists of a language-independent framework for editing and executing programs, and a language-dependent part driven by specifications. An Yggdrasil environment for a particular language is built by writing a specification for that language. The specification must define three fairly separate components of the language: its abstract syntax, its static semantics, and its execution semantics. The first two are used to enforce the static validity of the program as it is edited, while the third allows the system of execute the program via interpretation. Dissert. Abstr.

N86-16937 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
A PASCAL IMPLEMENTATION OF THE DES ENCRYPTION ALGORITHM INCLUDING CIPHER BLOCK CHAINING
A. A. Aruliah, G. I. Parkin, and B. A. Wichmann Jun. 1985 41 p refs
(NPL-DITC-61/85; ISSN-0262-5369) Copyright. Avail: Issuing Activity

A program which implements the Data Encryption Standard algorithm with Cipher Block Chaining was written in Pascal on a BBC Micro. Non standard Pascal is kept to a minimum, facilitating implementation on any machine with Pascal. The program is designed to be functionally equivalent to that implemented in the Software Protection Device (SPD) developed for the Software

Protection Consortium. It is functionally equivalent to that in the SPD in that both meet with the NBS Standard but is not identical to it, the SPD implementation being considerably faster.
Author (ESA)

N86-16938 CIAD, Zoetermeer (Netherlands).
[ACTIVITIES REPORT IN COMPUTER APPLICATIONS IN ENGINEERING] Annual Report, 1984 [JAARVERSLAG 1984]
1984 39 p refs In DUTCH
Copyright. Avail: Issuing Activity

Activities in 1984 to stimulate the integration of Computer Aided Design/Manufacturing (CAD/CAM) in (mainly small and medium) Dutch companies, are listed. Small design systems, geometric modeling, technology export, mutual communication between CAD systems, microcomputers, expert systems, computer aided management, automation within the production organization, digitizing techniques, quality aspects of finite element method calculations, and computer applications in crack mechanics are discussed. In civil engineering, the automation of estimate and construction costs, and the use of computer models to determine the collapse of rubble-mound breakwaters are studied.
Author (ESA)

N86-16939 CIAD, Zoetermeer (Netherlands).
TEST OF AUTOCAD [TEST AUTOCAD]
J. J. Duivenvoorden and C. Tjallema 1984 20 p In DUTCH
(A-14; ISBN-90-6818-016-9) Copyright. Avail: Issuing Activity

An AutoCAD version 2.0 computer aided design (CAD) configuration, containing an IBM-PC/AT, a mathematical 80287 coprocessor, a Cambridge Computer Graphics MC1024 screen, and an HP-Plotter 7580B (A1), was tested. After base figure construction, two dimensional design manipulations, transformations, reflections, rotations, reductions, and rescalings, were executed. Line-strings, edgings, parameterized forms, accuracy, draw-speed, data storage efficiency, and coupling possibilities with other programs, were investigated. The data base management system was examined. Positive points are: product philosophy (much can be simply defined by the user himself); open product (ASC2 exchange files); accuracy; operation comfort; attribute ascription; and coupling possibilities with microcomputer database programs. Negative points are: lacking functions, such as circle tangents and splines; complicated layer manipulations; roundabout way to cut off lines; reflections and rescalings (text and measures were also reflected and rescaled); response time. Author (ESA)

N86-16940*# Software and Engineering Associates, Inc., Carson City, Nev.
ENGINEERING AND PROGRAMMING MANUAL: TWO-DIMENSIONAL KINETIC REFERENCE COMPUTER PROGRAM (TDK) Final Report
G. R. Nickerson, L. D. Dang, and D. E. Coats Apr. 1985 480 p refs
(Contract NAS8-35931)
(NASA-CR-178628; NAS 1.26:168628; SN-63) Avail: NTIS HC A21/MF A01 CSCL 09B

The Two Dimensional Kinetics (TDK) computer program is a primary tool in applying the JANNAF liquid rocket thrust chamber performance prediction methodology. The development of a methodology that includes all aspects of rocket engine performance from analytical calculation to test measurements, that is physically accurate and consistent, and that serves as an industry and government reference is presented. Recent interest in rocket engines that operate at high expansion ratio, such as most Orbit Transfer Vehicle (OTV) engine designs, has required an extension of the analytical methods used by the TDK computer program. Thus, the version of TDK that is described in this manual is in many respects different from the 1973 version of the program. This new material reflects the new capabilities of the TDK computer program, the most important of which are described. Author

N86-16941# National Aerospace Lab., Tokyo (Japan).
A STUDY OF THE CLUSTERING METHOD FOR A HUGE SATELLITE IMAGE: HISTOGRAM MODE METHOD
Kohtaro Matsumoto, Masao Naka, and Hiromichi Yamamoto 1985 50 p refs In JAPANESE; ENGLISH summary
(NAL-TR-854; ISSN-0389-4010) Avail: NTIS HC A03/MF A01

The clustering technique is important as the unsupervised classifier in the realization of an automated satellite image analysis system. But rent cluster analysis methods are not suitable to deal with huge, multi-dimensional satellite images because of the dependency on initial partitions and the tremendous computational time required. To analize a huge satellite image, two new algorithms were developed, i.e., Multi-Layered Hashing Scheme and Histogram Mode Method. The first one is for the construction of a multi-dimensional histogram fro the huge satellite image data. And the second one is for deriving natural clusters from the histogram using the basic idea bove. The algorithms were implemented on the large scale pipeline computer (FACOM 230/75 APU), and have been successfully used. Some results are shown. Author

N86-16942*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIFEX: AN ADVANCED PROGRAMMABLE PIPELINED-IMAGE PROCESSOR
Donald B. Gennery and Brian Wilcox 1 Feb. 1985 48 p refs
(Contract NAS7-918)
(NASA-CR-176444; JPL-Pub-84-97; NAS 1.26:176444) Avail: NTIS HC A03/MF A01 CSCL 09B

PIFEX is a pipelined-image processor being built in the JPL Robotics Lab. It will operate on digitized raster-scanned images (at 60 frames per second for images up to about 300 by 400 and at lesser rates for larger images), performing a variety of operations simultaneously under program control. It thus is a powerful, flexible tool for image processing and low-level computer vision. It also has applications in other two-dimensional problems such as route planning for obstacle avoidance and the numerical solution of two-dimensional partial differential equations (although its low numerical precision limits its use in the latter field). The concept and design of PIFEX are described herein, and some examples of its use are given. Author

N86-16943*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IPLIB (IMAGE PROCESSING LIBRARY) USER'S MANUAL
Nettie D. Faulcon, James H. Monteith, and Keith Miller Dec. 1985 217 p
(NASA-TM-87646; NAS 1.15:87646) Avail: NTIS HC A10/MF A01 CSCL 09B

IPLIB is a collection of HP FORTRAN 77 subroutines and functions that facilitate the use of a COMTAL image processing system driven by an HP-1000 computer. It is intended for programmers who want to use the HP 1000 to drive the COMTAL Vision One/20 system. It is assumed that the programmer knows HP 1000 FORTRAN 77 or at least one FORTRAN dialect. It is also assumed that the programmer has some familiarity with the COMTAL Vision One/20 system. Author

N86-16944*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT OF A KNOWLEDGE ACQUISITION TOOL FOR AN EXPERT SYSTEM FLIGHT STATUS MONITOR
James D. Disbrow (Systems Control Technology, Inc.), Eugene L. Duke, and Victoria A. Regenie Jan. 1986 12 p refs Presented at the AIAA 24th Aerospace Sciences Meeting, Reno, Nev., 6-9 Jan. 1986
(NASA-TM-86802; H-1332; NAS 1.15:86802; AIAA-86-0240) Avail: NTIS HC A02/MF A01 Palo Alto, Calif.) CSCL 09B

Two of the main issues in artificial intelligence today are knowledge acquisition dion and knowledge representation. The Dryden Flight Research Facility of NASA's Ames Research Center is presently involved in the design and implementation of an expert system flight status monitor that will provide expertise and knowledge to aid the flight systems engineer in monitoring today's advanced high-performance aircraft. The flight status monitor can be divided into two sections: the expert system itself and the knowledge acquisition tool. The knowledge acquisition tool, the

means it uses to extract knowledge from the domain expert, and how that knowledge is represented for computer use is discussed. An actual aircraft system has been codified by this tool with great success. Future real-time use of the expert system has been facilitated by using the knowledge acquisition tool to easily generate a logically consistent and complete knowledge base. Author

N86-16945*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. Dept. of Electrical and Computer Engineering.
MULTIPROCESSOR SPARSE L/U DECOMPOSITION WITH CONTROLLED FILL-IN Final Report
Gita Alaghband (Colorado Univ., Boulder) and Harry F. Jordan (Colorado Univ., Boulder) Oct. 1985 39 p refs Submitted for publication
(Contract NAS1-17070; Grant AF-AFOSR-1089-85)
(NASA-CR-178016; ICASE-85-48; NAS 1.26:178016) Avail: NTIS HC A03/MF A01 CSCL 09B

Generation of the maximal compatibles of pivot elements for a class of small sparse matrices is studied. The algorithm involves a binary tree search and has a complexity exponential in the order of the matrix. Different strategies for selection of a set of compatible pivots based on the Markowitz criterion are investigated. The competing issues of parallelism and fill-in generation are studied and results are provided. A technque for obtaining an ordered compatible set directly from the ordered incompatible table is given. This technique generates a set of compatible pivots with the property of generating few fills. A new hueristic algorithm is then proposed that combines the idea of an ordered compatible set with a limited binary tree search to generate several sets of compatible pivots in linear time. Finally, an elimination set to reduce the matrix is selected. Parameters are suggested to obtain a balance between parallelism and fill-ins. Results of applying the proposed algorithms on several large application matrices are presented and analyzed. Author

N86-16946*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE HENRY DRAPER CATALOGUE (EDITION 1985)
Nancy G. Roman and Wayne H. Warren, Jr. Feb. 1985 32 p refs
(NASA-TM-87502; NSSDC/WDC-A-RS-84-18; NAS 1.15:87502) Avail: NTIS HC A03/MF A01 CSCL 09B

An updated, corrected and extended machine-readable version of the catalog is described. Published and unpublished errors discovered in the previous version was corrected; letters indicating supplemental stars in the BD have been moved to a new byte to distinguish them from double-star components; and the machine readable portion of The Henry Draper Extension (HDE) (HA 100) was converted to the same format as the main catalog, with additional data added as necessary. Author

N86-16947 Admiralty Marine Technology Establishment, Teddington (England).
USER'S GUIDE FOR A FORTRAN COMPUTER PROGRAM TO CALCULATE PROPELLER BLADE SECTIONS, PART A
D. J. Atkins Jul. 1985 39 p
(AMTE(N)-TM-85061-Pt-A; BR96905-Pt-A) Copyright. Avail: NTIS HC A03/MF A01

A FORTRAN computer program, known as MMG3, which generates cylindrical, planar, or conical sections of propeller blades defined on conical surfaces is described. A data specification is given, with two test examples and details of implementation on an HP21MX system. Author (ESA)

N86-16948# Centre de Recherches de l'Inst. Superieur Industriel Catholique du Hainaut (Belgium).
STRESSES AND DISPLACEMENTS IN A FOUR LAYERED SYSTEM WITH FIXED BOTTOM
F. VanCauwelaert 30 Apr. 1985 79 p
(Contract DAJA45-85-C-0013)
(AD-A156763; R/D-4928-EN-01) Avail: NTIS HC A05/MF A01 CSCL 09/2

This document describes research work necessary to fullfill the requirements of the contract that must lead to the establishment of a computer program to calculate all stressed and displacement in a four layered system with fixed bottom submitted to a series of loads. This report contains three parts: (1) A complete discussion of the interface conditions; (2) The demonstration that satisfying convergency can be obtained, and in the meantime overflow problems can be eliminated, if the equations are written in closeform although in a sufficient comprehensive form so that whole problem can still be overlooked but in such a way that all numerical problems can be solved; and (3) The complete algebraical analysis leading to the equations in extended form for an isotropic four-layered system. The analysis is also developed for a three-layered system to enable us to compare and to check the results with those obtained by means of reliable existing programs. Author

N86-16949# Hydrologic Engineering Center, Davis, Calif.
WATER SUPPLY SIMULATION USING HEC-5
Aug. 1985 146 p
(AD-A158888; HEC-TRAINING-20) Avail: NTIS HC A07/MF A01 CSCL 13/2

This document is intended to assist users of computer program HEC-5 who are engaged in modeling surface water systems for water supply. Using a single reservoir operation for illustration, the document describes the input data needed to utilize a variety of analysis capabilities available in HEC-5. Input data for multiple reservoir systems are similar to those for single reservoirs but include certain data which specify the system linkages and operation. A description of this information is also included. Two Appendices are part of the document. One describes HEC-5 automatic reservoir sizing and the other provides program output for the examples used in the text. Author (GRA)

N86-16950# Maryland Univ., College Park.
PARALLEL MATRIX COMPUTATIONS Interim Report, 9 Feb. 1983 - 16 May 1985
G. W. Stewart and D. P. OLeary 11 Apr. 1985 8 p
(Grant AF-AFOSR-0078-82)
(AD-A159252; AFOSR-85-0695TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of this effort is to develop realistic algorithms for matrix computations on parallel computers. It has been long observed that the usual algorithms of numerical linear algebra contain a great deal of inherent parallelism. For example, if the arithmetic operations that can be performed in parallel in Gaussian elimination are actually so executed, the time to decompose an nXn matrix is reduced from cu n to n only recently, with the emergence of cheap, small microcomputers, has it become feasible to exploit this parallelism on anything but a trivial scale there is under development a parallel system, called ZMOB, consisting of 256 micro-processors connected on a conveyor belt. This belt is so fast and its architecture is such that any two processors can communicate without interfering with the communications of other pairs of processors. Thus the ZMOB is an ideal tool for simulating an arbitrarily connected network of computers. This feature of the ZMOB is particularly useful in investigating parallel matrix algorithms. Interconnections between processors are expensive, and in a practical system one can assume only a limited amount of connectivity. The ZMOB provides a means of testing and comparing different types of interconnections, since all one has to do is use the rich connections provided by the ZMOB conveyor belt. GRA

N86-16951# Army Industrial Base Engineering Activity, Rock Island, Ill.
MANUFACTURING METHODS AND TECHNOLOGY PROJECT SUMMARY REPORTS Semiannual Report, Jan. - Jun. 1985
Jun. 1985 131 p
(AD-A159360; AD-E700020) Avail: NTIS HC A07/MF A01 CSCL 13/8

This report contains summaries of 47 projects that were completed under the Army's Manufacturing Methods and Technol-

ogy (MMT) Program. The MMT program was established to upgrade manufacturing facilities used for the production of Army Materiel. The summaries highlight the accomplishments and benefits of the projects and the implementation actions underway or planned. Points of contact are also provided for those who are interested in obtaining additional information. GRA

N86-16952# Argonne National Lab., Ill.
AIMING TOWARD PERFECTION WITH POBSYS, A NEW SOFTWARE SYSTEM
J. Osudar, J. E. Parks, and N. M. Levitz 1985 7 p Presented at the International Topical Meeting on Computer Applied for Nuclear Power Plant Operation and Control, Pasco, Wash., 8 Sep. 1985
(Contract W-31-109-eng-38)
(DE85-007986; CONF-850903-3) Avail: NTIS HC A02/MF A01

An integrated general-purpose software system, POBSYS, was developed that provides the foundation and tools for building a highly interactive system for carrying out detailed operating procedures and performing conventional process control, data acquisition, and data management functions. Features of the present system, which may be of particular interest to the problem of the man-machine interface include: (1) a multi-level safety system for fail-safe operation; (2) hierarchical operational control; (3) documented responsibility; (4) equipment status tracking; and (5) quality assurance checks on operations. The system runs on commerically available microprocessors and is presently in use in the destructive analysis of irradiated fuel rods from the Light Water Breeder Reactor. DOE

N86-16953# California Univ., Berkeley. Lawrence Berkeley Lab.
SOFTWARE TOOLS PROGRAMMER'S MANUAL
T. Breckon, V. Jacobson, C. Leres, V. Paxson, and N. Travis Apr. 1985 777 p
(Contract DE-AC03-76SF-00098)
(DE85-016421; LBL-PUB-3052) Avail: NTIS HC A99/MF A01

This manual covers programming tools available at the Lawrence Berkeley Laboratory. DOE

N86-16954# Sandia Labs., Albuquerque, N. Mex.
FORTRAN MULTITASKING LIBRARY FOR USE ON THE ELXSI 6400 AND THE CRAY XMP
G. R. Montry 16 Jul. 1985 61 p
(DE-AC04-76DP-00789)
(DE85-016223; SAND-85-1378) Avail: NTIS HC A04/MF A01

A library of FORTRAN-based multitasking routines has been written for the ELXSI 6400 and the CRAY XMP. This library is designed to make multitasking codes easily transportable between machines with different hardware configurations. The library provides enhanced error checking and diagnostics over vendor-supplied multitasking intrinsics. The library also contains multitasking control structures not normally supplied by the vendor. DOE

N86-16955# Argonne National Lab., Ill.
SYSTEMS ANALYSIS LANGUAGE TRANSLATOR (SALT): PROGRAMMER'S GUIDE
H. K. Geyer and G. F. Berry Mar. 1985 154 p
(Contract W-31-109-eng-38)
(DE85-016244; ANL/FE-85-4) Avail: NTIS HC A08/MF A01

The Systems Analysis Language Translator (SALT), a systems-analysis and process-simulation computer code for steady-state and dynamic systems, can also be used for optimization and sensitivity studies. The SALT code uses sophisticated numerical techniques, including a hybrid steepest-descent/quasi-Newtonian multidimensional nonlinear equation solver, sequential quadratic programming methods as optimizers, and multistep integration methods for both stiff and nonstiff systems or equations. Based on a preprocessor concept, the code uses precompiled component models, several flow types, and numerous thermodynamic and transport property routines. The SALT code has been used to study open-cycle and liquid-metal magnetohydrodynamic systems, fuel cells, ocean thermal energy conversion, municipal-solid-waste processing, fusion, breeder reactors and geothermal and solar-energy systems. This programmer's guide briefly describes the code, defines parameters used with the component models, and presents detailed examples of declaration structures to be used with these models. DOE

N86-16956# Sandia National Labs., Livermore, Calif.
TOPAZ: THE TRANSIENT ONE-DIMENSIONAL PIPE FLOW ANALYZER, USERS MANUAL
W. S. Winters Jul. 1985 54 p
(Contract DE-AC04-76DR-00789)
(DE85-017424; SAND-85-8215) Avail: NTIS HC A04/MF A01

TOPAZ is a user friendly computer code for modeling the one-dimensional-transient physics of multi-species gas transfer in arbitrary arrangements of pipes, valves, vessels, and flow branches. This document serves as a user's manual for the code, and should provide potential users with enough information to take advantage of many of the code's capabilities. Details regarding equations and numerics, example problems, applications, and modeling assumptions will be discussed in companion documents. DOE

N86-16957# Sandia National Labs., Albuquerque, N. Mex.
ECONOMICAL AND ROBUST ROUTINE FOR COMPUTING SPARSE JACOBIANS
D. E. Salane and L. F. Shampine May 1985 39 p
(Contract DE-AC04-76DP-00789)
(DE85-016829; SAND-85-0977) Avail: NTIS HC A03/MF A01

The numerical solution of a nonlinear system of algebraic or ordinary differential equations usually requires the formation of a Jacobian by finite differencing. In the solution of most problems, the Jacobian is evaluated repeatedly and at neighboring arguments. In this paper we will present a subroutine which is appropriate for forming Jacobians in such circumstances. The routine adjusts increments for differencing to control roundoff and truncation errors, but seldom requires more than one function evaluation to compute a column of the Jacobian. In addition, the routine takes advantage of sparsity in forming the Jacobian. This often leads to a significant reduction in the number of function evaluations required to compute the Jacobian. DOE

N86-16958# Lawrence Livermore National Lab., Calif.
GRAFL-2: USER ORIENTED SCIENCE GRAPHICS
B. McNamara and P. A. Willmann 18 Jun. 1985 34 p
(Contract W-7405-eng-48)
(DE85-017147; UCID-20467) Avail: NTIS HC A03/MF A01

GRAFL-II is a small set of plotting routines able to produce 95% of the 2-dimensional figures and plots in the scientific literature from your FORTRAN code. The routines and their arguments have been designed to give extensive control over this type of picture with the minimum of fuss. We offer these 28 routines as a standard for the FORTRAN-based front end to any graphics library. The routines have been implemented on the MFECC computers to run the GRAFLIB and VT80LIB systems developed at Livermore. Although some of the coding uses low-level GRAFCORE routines it is sufficiently well commented to be easily modified or rewritten to drive other graphics libraries and enable codes to be transported more easily. A partial translation to drive the CERN graphics system has been made for use at the International Center for Theoretical Physics, Trieste. DOE

N86-16959# Argonne National Lab., Ill.
USE OF MONITORS IN FORTRAN: A TUTORIAL ON THE BARRIER, SELF-SCHEDULING DO-LOOP, AND ASKFOR MONITORS, REVISION 1
E. L. Lusk and R. A. Overbeek Jun. 1985 56 p Previously announced as N85-14587
(Contract W-31-109-eng-38)
(DE85-017051; ANL-84-51-Rev-1) Avail: NTIS HC A04/MF A01

A set of macro libraries has been developed that allows programmers to write portable FORTRAN code for multiprocessors. This document presents, in tutorial form, the macros used to implement three common synchronization patterns: self-scheduling DO-loops, barrier synchronization, and the ask for monitor. DOE

N86-16960*# George Washington Univ., Washington, D.C. Inst. for Information Science and Technology.
THE LOOK-UP TABLE COMPILER
Charles F. McMath, James Acquah, and James D. Foley 24 May 1985 23 p
(Grant NAG1-538; Contract DE-AS05-83ER-13122)
(NASA-CR-176456; NAS 1.26:176456; DE85-013382; DOE/ER-13122/5) Avail: NTIS HC A02/MF A01 CSCL 09B

The roster extensions to the GSPC Core and certain aspects of GKS do provide a start of abstracting raster concepts, but provide only very low-level support for three of the hallmarks of many raster displays pixel matrixes, raster-op, and the look-up table. In 1982 a conceptual model of raster system architectures was developed, and a language was specified for defining operations on pixel matrixes which would be implemented by calculating the contents of a raster displays look-up table such that the effects of the operations would be seen on the display monitor. An implementation of the concepts found in a previous report is presented. Because the system generates look-up table contents from a language specification, the system is called the Look-up Table Complier. Author

N86-16961# Lawrence Livermore National Lab., Calif.
METHOD FOR SIMULATING RADIOGRAPHS USING A SOLID MODELER
G. Laguna 18 Mar. 1985 6 p Presented at the ASME International Computers in Engineering Conference and Exhibition, Boston, 4 Aug. 1985
(Contract W-7405-eng-48)
(DE85-012963; UCRL-92339; CONF-850862-3) Avail: NTIS HC A02/MF A01

A method for computer simulation of radiographs has been added to the Lawrence Livermore National Laboratory version (1) of the solid modeler TIPS-1 (Technical Information Processing System-1). We believe this to be the first implementation of simulated radiographs in any solid modeler. This new tool will enable the engineer to compare an actual radiograph of a solid to its computer-generated counterpart; any discrepancies between the two become candidates or flaws. Simulated radiographs can also be used: (1) to preview the placement of X-ray sources to focus on areas of concern before actual radiographs are made, and (2) to aid in the design of a system such that it is physically possible to obtain actual radiographs of critical areas. DOE

N86-16962# Los Alamos National Lab., N. Mex.
SPEEDUP PREDICTIONS ON LARGE SCIENTIFIC PARALLEL PROGRAMS
E. Williams and F. Bobrowicz 1985 5 p Presented at the International Conference on Parallel Processing, St. Charles, Ill., 20 Aug. 1985
(Contract W-7405-eng-36)
(DE85-010749; LA-UR-85-1391; CONF-850842-2) Avail: NTIS HC A02/MF A01

The amount of speedup that can be expected from large scientific parallel programs running on supercomputers is discussed. For insight into this problem the parallel processing environment currently existing on the Cray X-MP (a shared memory multiprocessor with at most four processors) is extended to a simulated N-processor environment, where N greater than or equal to 1. Several large scientific parallel programs from Los Alamos National Laboratory were run in this simulated environment, and speedups were predicted. A speedup of 14.4 on 16 processors was measured for one of the three most used codes at the Laboratory. DOE

N86-16963# Los Alamos National Lab., N. Mex.
EARLY HISTORY OF COMPUTER SIMULATIONS IN STATISTICAL MECHANICS
W. W. Wood 24 Jun. 1985 32 p Presented at the International School of Physics on Molecular Dynamical Simulation of Statistical Mechanics Systems, Varenna, Italy, 23 Jul. 1985 Prepared in cooperation with Carroll Coll., Helena, Mont.
(Contract W-7405-eng-36)
(DE85-014067; LA-UR-85-2292; CONF-850764-1) Avail: NTIS HC A03/MF A01

A history of the early use of the Monte Carlo is presented. DOE

N86-16964# Sandia National Labs., Albuquerque, N. Mex.
RECTILINEAR AREA ROUTING: A CHANNEL ROUTER APPROACH
J. A. Hudson, M. M. Wada, and R. Peters 1985 4 p Presented at the International Conference on Computer Design, Port Chester, N.Y., 7 Oct. 1985 Prepared in cooperation with Kirk-Mayer, Inc., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE85-014460; SAND-85-0724C; CONF-8510113-1) Avail: NTIS HC A02/MF A01

A final router has been developed which operates upon the rectilinear channel routing areas created by rectilinear macrocells. The router supports input and output pins on all sides of the rectilinear area. After the channel density estimation for the entire assembly is provided by a global router, the rectilinear area is partitioned into smaller rectangular regions which can be routed by applying traditional channel router methods. The regions are ordered, and a global routing of the nets within the rectilinear area is performed. The regions are routed individually while providing a smooth area routing. Algorithms for each phase of the final routing are described. Special rectilinear topological considerations are presented. The algorithms are implemented in Pascal on a DEC-SYSTEM 20 as a part of SLS Sandia layout system, a hierarchical layout system. DOE

N86-16965# Los Alamos National Lab., N. Mex.
USING COMPUTERS TO ANSWER FUNDAMENTAL QUESTIONS IN COMBUSTION THEORY: AN EXAMPLE FROM DROPLET COMBUSTION
R. D. Janssen and P. J. ORourke 1985 20 p refs Presented at the 17th AMS-SIAM Summer Seminar in Applied Mathematics, Ithaca, N.Y., 30 Jun. 1985
(Contract W-7405-eng-36)
(DE85-015681; LA-UR-85-2332; CONF-8506169-2) Avail: NTIS HC A02/MF A01

Many fundamental questions in combustion theory are either partially or totally intractable analytically. Thus, it is often desirable to use computed results to supplement information obtained by analytic means. We illustrate how computation can supplement analysis by examining the role of gas-phase unsteadiness in droplet vaporization and combustion. DOE

N86-16966# Bettis Atomic Power Lab., West Mifflin, Pa.
COMPUTATIONAL EFFICIENCY USING THE CYBER-205 COMPUTER FOR THE PACER MONTE CARLO PROGRAM
N. R. Candelore, C. M. Maher, and R. C. Gast Sep. 1985 12 p Presented at the Westinghouse Engineering Computer Applications Symposium, Monroeville, Pa., 7 Oct. 1985
(Contract DE-AC11-76PN-00014)
(DE85-017635; WAPD-T-2871; CONF-8510149-4) Avail: NTIS HC A02/MF A01

The use of the large memory of the CYBER-205 and its vector data handling logic produced speedups over scalar code ranging from a factor of 7 for unit cell calculations with relatively few compositions to a factor of 5 for problems having more detailed geometry and materials. By vectorizing the neutron tracking in PACER (the collision analysis remained in scalar code), an asymptotic value of 200 neutrons/cpu-second was achieved for a batch size of 10,000 neutrons. The complete vectorization of the Monte Carlo method as performed by Brown resulted in even higher speedups in neutron processing rates over the use of scalar code. Large speedups in neutron processing rates are beneficial not only to achieve more accurate results for the neutronics calculations which are routinely done using Monte Carlo, but also to extend the use of the Monte Carlo method to applications that were previously considered impractical because of large running times. DOE

N86-16967# California Univ., Berkeley. Lawrence Berkeley Lab.
INCORPORATION OF BOUNDARY CONDITION INTO THE PROGRAM POISSON
S. Caspi, M. Helm, and L. J. Laslett Aug. 1985 6 p Presented at the 9th International Conference on Magnet Technology, Zurich, Switzerland, 9 Sep. 1985
(Contract DE-AC03-76SF-00098)
(DE85-017668; LBL-19172; CONF-850920-1) Avail: NTIS HC A02/MF A01

Two dimensional Cartesian and axially-symmetric problems in electrostatics or magnetostatics frequently are solved numerically by means of relaxation techniques - employing, for example, the program POISSON. In many such problems the sources (charges or currents, and regions of permeable material) lie exclusively within a finite closed boundary curve and the relaxation process in principle then could be confined to the region interior to such a boundary - provided a suitable boundary condition is imposed onto the solution at the boundary. This paper discussed and illustrates the use of a boundary condition of such a nature, in order thereby to avoid the inaccuracies and more extensive meshes present when alternatively a simple Dirichlet or Neumann boundary condition is specified on a somewhat more remote outer boundary. DOE

N86-16968# Oak Ridge Y-12 Plant, Tenn.
VERIFICATION OF CAD-BASED DATA EXCHANGE
R. M. Wilson Sep. 1985 16 p
(Contract DE-AC05-84OS-21400)
(DE85-017985; Y/EN-1350) Avail: NTIS HC A02/MF A01

Maintaining data integrity during exchanges between CAD systems, inter-CAD exchange, becomes increasingly critical as CAD systems evolve into the primary repository for mechanical design data. Manufacturing's requirement for high confidence production data coupled with the unreliable performance of current transfer implementations necessitates the advance of inter-CAD data integrity verification. With the widening scope of applications utilizing CAD-based design data, verification techniques in addition to the current method of visual comparison need to be created in order to verify pictorial, mathematical and structural attributes. Simple post transfer verification can be augmented by the detailed testing of inter-CAD transfer methodologies and a diversity of data integrity analysis algorithms. DOE

N86-16969# Research Inst. of National Defence, Stockholm (Sweden).
THE POC COMPUTER AIDED SYSTEM FOR SITUATIONAL SURVEILLANCE OF LAKE TRAFFIC
Hans Marmolin, Carl-Eric Hedin, Ulf Berggrund, Beng Ahlstroem, Gunilla Derefeldt, and Christer Sahlin Apr. 1985 33 p refs In SWEDISH; ENGLISH summary
(FOA-A-50003-H2; ISSN-0281-0239) Avail: NTIS HC A03/MF A01

An interactive display system, developed for a military missile and ammunition test area, for surveillance of the traffic on a lake is described. The system integrates information from several sources into a uniform situational map, and provides the necessary facilities for guiding the traffic, and for analyzing and documenting the situation. Author (ESA)

N86-16970# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
STUDIES OF SEEKER ALGORITHMS FOR INFRARED SENSORS AGAINST SURFACE TARGETS
Anders Wallin Jun. 1985 24 p In SWEDISH; ENGLISH summary
(FOA-C-30389-E3; ISSN-0347-3708) Avail: NTIS HC A02/MF A01; Research Institute of National Defence, Stockholm KR 50

A simulation program was developed to study signal processing of low resolution images. By choosing suitable parameters, it is possible to process for target recognition. The program consists of segmentation and target acquisition. Segmentation finds a form of contrast of the target against the background: in the infrared area, the target often has a higher temperature. A linear or surface distortion (shrinkage) is then carried out, followed by a thresholding in accordance with given parameters. The basis of the target acquisition is made by extracting qualities for every target candidate. Author (ESA)

N86-16971# Research Inst. of National Defence, Linkoeping (Sweden).
OBJECT RECOGNITION USING THE HIERARCHICAL CHAMFER MATCHING ALGORITHM
Gunilla Borgefors Jun. 1985 42 p refs
(FOA-C-30395-E1; ISSN-0347-3708) Avail: NTIS HC A03/MF A01; Research Inst. of National Defence, Stockholm KR 50

The performance of the so-called hierarchical chamfer matching algorithm in the recognition of objects in digital gray-level images is described. The objects used are common tools. The algorithm is used for identifying and finding the location of the tools, in a number of images of varying complexity. Results show that the performance of the hierarchical chamfer algorithm is very satisfactory, even for complex scenes. Author (ESA)

N86-16972# Research Inst. of National Defence, Linkoeping (Sweden).
DISTANCE TRANSFORMATIONS IN DIGITAL IMAGES
Gunilla Borgefors Aug. 1985 64 p refs
(FOA-C-30401-E1; ISSN-0347-3708) Avail: NTIS HC A04/MF A01; Research Inst. of National Defence, Stockholm KR 50

Distance transformations, optimal in that the maximum difference from the Euclidean distance is minimized, are computed. Local neighborhoods of size up to 7x7 pixels are investigated. A distance transformation is presented. It is easily computed and has a maximum error of 2%. Six different distance transformations are used in three different applications: (1) computing the distance from an object; (2) computing pseudo-Dirichlet tessellations; and (3) smoothing binary images. The applications show that the choice of distance transformation is important, and that any of the six transformations may be the right choice. Author (ESA)

N86-16973# Oxford Univ. (England). Dept. of Engineering Science.
FAUST: USERS GUIDE
P. S. Tuffs and C. Mohtadi 1985 36 p
(OUEL-1582/85) Avail: NTIS HC A03/MF A01

Commissioning of a self-tuner using the FAUST package in one of three modes: Internal simulation, External Real-time control, and Two-task simulation is outlined. It is assumed that the user is already familiar with the particular algorithm used, and the guide is used as a means of reference. Author (ESA)

N86-16974# Oxford Univ. (England). Dept. of Engineering Science.
FAUST: PROGRAMMERS REFERENCE GUIDE
P. S. Tuffs and C. Mohtadi 1985 64 p
(OUEL-1583/85) Avail: NTIS HC A04/MF A01

A guide for programmers of self-tuning control algorithms who wish to install a new control law into the FAUST single-loop package is presented. A complete listing of all the variables in the FDB data base common-blocks and a lookup table for the examine and deposit run-time commands are given. A cross-reference list of the routines called by each subroutine in the FDB and STC algorithm executable modules is provided to aid the design of an overalay structure on machines which have a small amount of available memory, such as the LSI-11 under RT-11. Author (ESA)

N86-16975# Oxford Univ. (England). Dept. of Engineering Science.
PROTOTYPE POST PROCESSOR FOR A COMPUTER-AIDED COLD FORGING WORKPLANNING SYSTEM
P. Bariani and W. A. Knight 1985 48 p refs
(OUEL-1590/85) Avail: NTIS HC A03/MF A01

A computer aided procedure for the complete timing of automatic multistation cold heading machines, which is a typical post-processor in a suite of interactive programs for cold forging process planning was designed. In addition to timing the transfer system and station actions, the post-processor capabilities include the interactive design of nonstandard devices for blank gripping and automatic graphical proving of the timing plan against collisions, thus permitting a complete error-free timing table to be obtained as a final printout. Author (ESA)

N86-16976# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.

A 3-D POISSON SOLVER BASED ON A CONJUGATE GRADIENT ALGORITHM

H. Kapitza and D. Eppel 1985 33 p refs (GKSS-85/E/23; ISSN-0344-9629) Avail: NTIS HC A03/MF A01

A program for the solution of the three-dimensional Poisson Equation in Cartesian coordinates is described. The algorithm consists of a conjugate gradient technique accelerated by an incomplete Crout factorization of the matrix. There are no restrictions on the number of unequally spaced grid points in the three coordinate directions. The efficiency of the algorithm does not depend on a relaxation parameter and is superior to Red-Black-SOR. Author (ESA)

N86-16977# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

TWO ADA MATHEMATICAL FUNCTIONS PACKAGES FOR USE IN REAL TIME

J. Kok Jun. 1985 13 p ref Submitted for publication (CWI-NM-R8512; B8569859) Avail: NTIS HC A02/MF A01

Two portable Ada packages for the provision of basic mathematical functions in a form suitable for real-time processing are proposed. The packages satisfy the requirements given in the Guidelines for the design of large modular scientific libraries in Ada with regard to services requested by real-time processes. Author (ESA)

N86-16978# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.

AN INTRODUCTION TO PARALLELISM IN COMBINATORIAL OPTIMIZATION

G. A. P. Kindervater and J. K. Lenstra Feb. 1985 19 p refs Submitted for publication (CWI-OS-R8501; B8569334) Avail: NTIS HC A02/MF A01

Literature on parallel computers and algorithms relevant for combinatorial optimization was surveyed. Theoretical and realistic machine models, and the complexity theory for parallel computations are discussed. Examples of polylog parallel algorithms and log space completeness results for P are given, and the use of parallelism in enumerative methods is reviewed. Author (ESA)

N86-16979# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.

STOCHASTIC INTEGER PROGRAMMING BY DYNAMIC PROGRAMMING

B. J. Lageweg, J. K. Lenstra, A. H. G. RinnooyKan (Erasmus Univ., Rotterdam, Netherlands), and L. Stougie (Groningen Rijksuniv. Netherlands) Apr. 1985 23 p refs Submitted for publication (CWI-OS-R8503; B8569336) Avail: NTIS HC A02/MF A01

Optimization models in stochastic programming are considered. The dynamic programming algorithms for two-stage scheduling, bin packing and multiknapsack problems are studied. The numerical results are compared with results obtained by heuristics for the scheduling and bin packing problem. The computational experience gives empirical insight into the shape of the value functions of stochastic integer programming problems and shows the existence of discontinuities and nonconvexities. The results can be regarded as a first theory for stochastic integer programming. Author (ESA)

N86-16980# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.

MULTIGRID METHODS: DEVELOPMENT OF FAST SOLVERS

P. W. Hemker (Mathematical Center, Amsterdam, Netherlands), R. Kettler, P. Wesseling, and P. M. deZeeuw (Mathematical Center, Amsterdam, Netherlands) 1983 25 p refs Presented at International Multigrid Conference, Copper Mountain, Colo., 6-8 Apr. 1983 (Rept-83-05) Avail: NTIS HC A02/MF A01

Numerical and programming aspects of multigrid algorithms for the solution of discretized linear elliptic equations are discussed. The aim is to obtain software that is perceived and can be used like any standard subroutine for solving systems of linear equations. The user has to specify only the matrix and the right-hand-side, and remains unaware of the underlying multigrid method. A large class of equations can be solved efficiently in this way. The equation may be non self-adjoint, and its coefficients are arbitrary. The treatment of the convection-diffusion equation at high Peclet number is considered. A portable FORTRAN code, which vectorizes satisfactorily is outlined, and time statistics for a CYBER-205 are given. Author (ESA)

N86-16981# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.

A SIMPLIFIED THEORY FOR NONHERTZIAN CONTACT

J. J. Kalker 1983 12 p refs Presented at IAVSD-Meeting, Cambridge, Mass., 15-19 Sep. 1983 (Rept-83-22) Avail: NTIS HC A02/MF A01

A theory for contact formation and for frictional rolling, in which the contact area is not known in advance, and may be nonhertzian is proposed. The program first determines the contact area on the basis of the given total normal force, and then applies the FASTSIM algorithm in the contact area on the basis of the given creepages and the spin, to find the total tangential force. In the Hertzian case the program was compared with the 1982 FASTSIM program and it is found that the algorithms are equally accurate, but that the new program is three times slower than the old one. Author (ESA)

N86-16982# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.

COMPUTER ASSISTED INSTRUCTION (CAI) SYSTEMS IN THE NETHERLANDS [COO-SYSTEMEN IN NEDERLAND]

Charles vanderMast 1984 36 p refs In DUTCH Sponsored by Stitching voor Onderzoek van het Onderwijs SVO, The Hague, Netherlands The Hague, Netherlands (Rept-84-45) Avail: NTIS HC A03/MF A01

The state of the art of computer assisted instruction (CAI) systems in the Netherlands in 1984 is reviewed. An inventory of CAI material in the Netherlands is given. Starting from national and international developments it is was examined how fundamental and applied research and development have to be directed in order to enhance the knowledge of CAI and its possible significance for regular education in the Netherlands. Author (ESA)

N86-16983# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.

A CLASSROOM EDITOR FOR COMPUTER ASSISTED INSTRUCTION (CAI) [EEN KLASEDITOR VOOR COMPUTER ONDERSTEUND ONDERWIJS (COO)]

M. Lootens and C. vanderMast 1984 16 p refs In DUTCH (Rept-84-46) Avail: NTIS HC A02/MF A01

A classroom editor for CAI material is described. The modular CAI-system Delft is equipped with a full-screen editor for teachers which allows modifications to existing CAI-material, in a simple way. The possibilities and the first experiences with this class editor are depicted. The design and implementation of the editor are described. The class editor is well accepted. It is very well suited to optimize existing CAI-material for the possibilities of a

certain type of screen. It is also suited to instruct teachers about the possibilities of CAI. Author (ESA)

N86-16984# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
INPUTTING CONSTRUCTIVE SOLID GEOMETRY REPRESENTATIONS FROM TWO-DIMENSIONAL ORTHOGRAPHIC ENGINEERING DRAWINGS
Ho Bin (South China Institute of Technology, Guangzhou, China) 1984 25 p refs
(Rept-84-49) Avail: NTIS HC A02/MF A01

An approach to inputting geometric representations of three-dimensional objects via two-dimensional orthographic views is introduced. The user has to identify, from an engineering drawing, the primitive volumes such as cuboids, cylinders and spheres, from which a model of the object is constructed. The identified primitives have to be input. Their dimensions and transformation parameters are derived by the program from a set of points input via a digitizer from two or three views of the object on a single drawing. Set operations for combining the primitives are input separately. Based on this input, the system produces a Constructive Solid Geometry (CSG) representation of the object. Input of a CSG representation appears simpler for the user and for the system than input of the object via a boundary representation in terms of points, lines, and faces. Author (ESA)

N86-16985# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
A VISUAL DISPLAY FOR HIERARCHICAL CLASSIFICATION
Peter J. Rousseeuw 1985 30 p refs
(Rept-85-05) Avail: NTIS HC A03/MF A01

Representation of hierarchical classifications by the banner, a display based on the icicle plot of Kruskal and Landwehr (1983) is proposed. The banner is easy to program, can always be printed as a whole, and leads in a natural way to coefficients describing the cluster quality of the data set, i.e., the agglomerative coefficient and the divisive coefficient. Examples are given, and the relations with other graphical displays are sketched. Author (ESA)

N86-16986# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
A NOTE ON THE PAY-OFF MATRIX IN MULTIPLE OBJECTIVE PROGRAMMING
Matthijs Kok and Jaap Spronk (Erasmus University) 1985 13 p refs
(Rept-85-06) Avail: NTIS HC A02/MF A01

Use of the pay-off matrix in multiple objective programming for the calculation of the ideal vector and the nadir vector is discussed. When the separate optimization of the individual goal variables does not result in unique optimal solutions, the corresponding nadir vector is not uniquely defined. Negligence of this phenomenon can have a serious effect on multiple objective programming methods. The notion of nadir vector is redefined to take account of the possibility of alternative optimal solutions. A procedure which generates this uniquely defined nadir vector is presented. Author (ESA)

N86-16987# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
CLUSTERING LARGE DATA SETS
Leonard Kaufman (Brussels Univ., Belgium) and Peter J. Rousseeuw 1985 15 p refs
(Rept-85-13) Avail: NTIS HC A02/MF A01

The computer program CLARA for partitioning very large data sets is introduced. The number of calculations and memory requirements are of the order 0(n) where n is the number of objects. Clustering is carried out in two steps. A sample of n objects is drawn from the data set and clustered into k subsets using the k-medoid model, which also gives k representative objects. Then each object not belonging to the sample is assigned to the nearest of the k. This yields a clustering of the entire set of objects. A measure of the quality of this clustering is obtained by computing the average distance between all the objects of the data set and their representative objects. After m samples are clustered, the one for which the lowest average distance is obtained is selected. Author (ESA)

N86-16988# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
GEOMETRY MODELING IN COMPUTER AIDED DESIGN: AN OVERVIEW
C. D. Balch 1983 30 p refs
(Lab-Rept-755) Avail: NTIS HC A03/MF A01

Aspects of computer graphics which are relevant to geometry modeling of structures are discussed. Geometry representation schemes are described. Computational problems in the geometric modeling of solids are reviewed. Author (ESA)

N86-16989# European Space Agency, Paris (France).
MAXIMUM-LIKELIHOOD ESTIMATION OF PARAMETERS IN LINEAR SYSTEMS FROM FLIGHT TEST DATA. A FORTRAN PROGRAM
Ermin Plaetschke and David Brian Mackie Jun. 1985 94 p refs Transl. into ENGLISH of "Maximum-likelihood-Schaetzung von Parametern linearer Systeme aus Flugversuchsdaten - ein FORTRAN-Program" Report DFVLR-Mitt-84-10, Brunswick, West Germany, 1984 Original report in GERMAN previously announced as N85-14588
(ESA-TT-896; DFVLR-Mitt-84-10) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne DM 31

A program for the maximum-likelihood estimation of aerodynamic parameters in linear systems was developed. The mathematical background is outlined. A list of the input data and the flow charts of the main program and the maximum-likelihood subroutine are presented. Practical handling of the program and its options is demonstrated on two examples. The complete main program and comment listings of the subroutines are given. Author (ESA)

N86-16447# University of Electro-Communications, Tokyo (Japan).
COMPUTER AS A MODEL AND COMPUTER AS A TOOL: CP/M-80 SIMULATOR ON VOS3/TSS
Kazumiti Numata and Yuichi Aida *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 67-74 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

N86-16580# Joint Publications Research Service, Arlington, Va.
USE OF MICROPROCESSOR FOR IMAGE PROCESSING
Liu Weixian, Sun Xuemei, and Li Kaili *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 69-73 Transl. into ENGLISH from Weijisuanji Yingyong (Beijing, China), v. 6, no. 2, Mar. 1985 p 47-49 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

N86-16581# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER FAST FOURIER TRANSFORM SYSTEM DESCRIBED
Jiang Yinlin *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 74-83 refs Transl. into ENGLISH from Weijisuanji Yingyong (Beijing, China), v. 6, no. 2, Mar. 1985 p 18-24 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

N86-16929# Joint Publications Research Service, Arlington, Va.
SEPARATE COMPILATION MECHANISM IN ADA LANGUAGE PROGRAMMING SYSTEM
A. B. Gorubov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 35 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 1, Jan.-Feb. 1985 p 16-25 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

62 COMPUTER SYSTEMS

Includes computer networks.

N86-16990 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
SEVENTH ANNOTATED BIBLIOGRAPHY OF RECENT PUBLICATIONS ON DATA SECURITY AND CRYPTOGRAPHY
W. L. Price Aug. 1985 24 p refs
(NPL-DITC-64/85; ISSN-0262-5369) Copyright. Avail: Issuing Activity

Some 150 references concerning data security and cryptography are described and included in the seventh annotated bibliography of recent publications on data security and cryptography.
Author (ESA)

N86-16991*# Computer Technology Associates, Inc., Columbia, Md.
GATEWAY DESIGN SPECIFICATION FOR FIBER OPTIC LOCAL AREA NETWORKS
29 Aug. 1985 61 p
(Contract NAS5-28583)
(NASA-CR-177823; NAS 1.26:177823) Avail: NTIS HC A04/MF A01 CSCL 09B

This is a Design Specification for a gateway to interconnect fiber optic local area networks (LAN's). The internetworking protocols for a gateway device that will interconnect multiple local area networks are defined. This specification serves as input for preparation of detailed design specifications for the hardware and software of a gateway device. General characteristics to be incorporated in the gateway such as node address mapping, packet fragmentation, and gateway routing features are described. Author

N86-16992# Los Alamos National Lab., N. Mex.
LINKED STATE MACHINES: COMPOSITION, VOLUME 2
H. K. Knudsen Apr. 1985 32 p
(Contract W-7405-eng-36)
(DE85-017946; LA-10400-MS-Vol-2) Avail: NTIS HC A03/MF A01

The composition of a linked state machine (LSM) is a procedure whereby the LSM can be re-represented or realized by an LSM that contains a smaller number of elementary state machines but has identical state behavior. The existence of a procedure for composition is one of the characterizing features of an LSM. A procedure for the composition of the special class of modified, marked Petri nets that are used to represent LSMs is given, and the properties of LSMs obtained through composition are derived. Next, staged or iterated composition is studied. Finally, procedures are derived for the composition of asynchronous LSMs. DOE

N86-16993# Oak Ridge National Lab., Tenn.
ANALYTICAL EVALUATION OF COMPUTER-BASED DECISION AIDS
R. A. Kisner 1985 8 p refs Presented at the International Topical Meeting on Computer Applications for Nuclear Power Plant Operation and Control, Pasco, Wash., 8 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017157; CONF-850903-11) Avail: NTIS HC A02/MF A01

This paper introduces a method for evaluating decision aids for nuclear power plant operators. The method involves a two-stage process of classification and analytical evaluation of display form and content. The classification scheme relates each specific aid to one or more general decision-making tasks. Evaluation then proceeds using a normative top-down design process based on the classification scheme by determining or deducing how various design issues associated with this process were resolved by the designer. The result is an assessment of the understandability of the aid as well as identification of the training and display features necessary to ensure understandability. DOE

N86-16994# California Univ., Berkeley. Lawrence Berkeley Lab.
USING COOPERATIVE SIMULTANEOUS PARALLELISM IN NONHOMOGENEOUS MICROCOMPUTER CLUSTERS
J. Meng Oct. 1984 8 p refs Presented at the International Society for Mini and Microcomputers International Symposium on Applications of Microcomputers, New York, N.Y., 22 Oct. 1984
(Contract DE-AC03-76SF-00098)
(DE85-017638; LBL-17801; CONF-8410320-1) Avail: NTIS HC A02/MF A01

Based on our experience controlling different types of microprocessors in clusters through the central processor-memory connection, and based on our successful parallel operation of a cluster of minicomputer central processors, a MIDAS-like arrangement of different microcomputers in a cluster is useful in dealing with a variety of problems. The MIDAS-like arrangement refers to master-slave control of the cluster by a minicomputer and to data being passed through the cluster by connecting prefilled memories into and out of processor address space. We discuss how to connect the hardware into a cluster and conclude with descriptions of how to apply the hardware to selected diverse applications.
DOE

N86-16995# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE ROSAT POSITION SENSITIVE PROPORTIONAL COUNTER (PSPL) SCIENTIFIC DATA PROCESSING REQUIREMENT DOCUMENT
B. Aschenbach, comp., H. Braeuninger, comp., U. Briel, comp., H. Fink, comp., G. Hasinger, comp., H. Hippmann, comp., E. Pfeffermann, comp., P. Predehl, comp., J. Schmitt, comp., and K. H. Stephan, comp. Jun. 1985 153 p
(MPE-IN-44; ISSN-0340-8922) Avail: NTIS HC A08/MF A01

The scientific concepts of the ROSAT mission and characteristics of the scientific payload are described to derive specifications for the scientific software system necessary to analyze the survey data and the data of the pointed observations provided by the Position Sensitive Proportional Counter. The specifications are complete at the level of knowledge 3 yr before launch.
Author (ESA)

N86-16996# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
NETWORKS OF MACHINES FOR DISTRIBUTED RECURSIVE COMPUTATIONS
Alain J. Martin (California Inst. of Technology, Pasadena, Calif.) and Jan L. A. vandeSnepscheut 1985 11 p refs
(CS-8502) Avail: NTIS HC A02/MF A01

Distributed computation viewed as a communicating processes is considered. A class of processor networks that admits a homogeneous distribution of processes and trivial routing is described. The problem of implementing a distributed computation is solved by two criteria which are characterized for networks of machines for distributed recursive computations. Author (ESA)

N86-16997# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
PARALLEL UNCONSTRAINED OPTIMIZATION METHODS
F. A. Lootsma 1984 35 p refs
(Rept-84-30) Avail: NTIS HC A03/MF A01

Unconstrained optimization for implementation on parallel computers is surveyed. Simultaneous evaluations of the function to be optimized are considered. Conjugate directions, homogeneous functions, variable-metric methods, and multidimensional searches are discussed. Trends in computational studies of parallel optimization algorithms are assessed. Author (ESA)

N86-16998# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
INTERCONNECTION STRATEGIES FOR TIGHTLY COUPLED MULTIPROCESSOR SYSTEMS
J. Hans Andriessen and Nikola A. Kasabov (Higher Institute of Mechanical and Electrical Engineers, Sofia, Bulgaria) 1985 17 p refs
(Rept-85-10) Avail: NTIS HC A02/MF A01

A combined parallel/sequential data exchange method is described. For systems with a large number of processors (of the

order of 1000 or 10,000) hardware requirements of the I/O-part of these processors are drafted. Low-level strategies (full-line and full-information type of connections) to connect a small number of processors are applied to high-level strategies (recursive segmentation and pipeline structures) to connect a large number of processors. Interconnection of large systems by these strategies is evaluated. For low-level interconnection, the full-information connection is better than full-line connection, for at the same cost of data exchange time it requires less external inputs and utilizes the inner cluster connection optimally. For high-level interconnection recursive segmentation is preferable to bidirectional double pipeline structures. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N86-16999 Toledo Univ., Ohio.
A MICROCOMPUTER BASED CLOSED LOOP SPEED CONTROLLER FOR AN INDUCTION MOTOR Ph.D. Thesis
Hamid Monazahian 1985 176 p
Avail: Univ. Microfilms Order No. DA8516745

The hardware and software techniques used to implement a microcomputer based, variable speed, closed loop induction motor drive system is described. The advantage of this system is that the inverter is digitally controlled and the motor is the only analog device in the system. The digital controller deices a pulse width modulated (PWM), inverter fed, three phase induction motor in the variable speed mode. Algorithms were implemented for maximum acceleration rate with improved efficiency. The PWM inverter accomplishes voltage and frequency adjustment in a single circuit. A set of six optimized PWM waveforms are generated by a microcomputer, which references look-up tables for the appropriate switching angles. The switching angles are precalculated prior to storage into memory, thus eliminating the need for real-time calculations. Frequency control is achieved by an 8 bit counter which is incremented by a progammable interval timer at a rate directly proportional to the desired motor frequency. Dissert. Abstr.

N86-17000 Carnegie-Mellon Univ., Pittsburgh, Pa.
FIDO: VISION AND NAVIGATION FOR A ROBOT ROVER Ph.D. Thesis
Charles Elving Thorpe 1984 146 p
Avail: Univ. Microfilms Order No. DA8517537

FIDO is a vision and navigation system for a mobile robot. Using only stereo vision, FIDO is capable of guiding a robot through clutter to reach a goal. FIDO stars with no preloaded map of the world, and needs no special preparation of the environment; it works in the real world rather than in a toy environment. Four of FIDO's major contributions are described. They are: (1) path relaxation; (2) interest operators; (3) constraints; and (4) parallel decomposition. Dissert. Abstr.

N86-17001 Johns Hopkins Univ., Baltimore, Md.
THE MOVEMENTS OF MULTILINK ROBOT ARMS IN TWO-DIMENSIONAL REGIONS Ph.D. Thesis
Vitit Kantabutra 1985 91 p
Avail: Univ. Microfilms Order No. DA8518494

An algorithm, requiring O(n) computation time, which moves an arm in a circle to any reachable configuration in O(n) moves is presented. Also given is an O(n) computation time algorithm that computes all the regions reachable by the joints of such an arm. This procedure is faster and intuitively simpler than the one given by Hopcroft, et al. Then an O(n) method of deciding the reachability of a configuration is offered in the case of a short-linked robot arm, with an end fixed positionwise, confined within a square. Following this, a linear time algorithm is established for determining whether a given point in a square can be reached by an end of an arm, when no end is fixed and no link is longer than a side of the square. Finally, an O(n cubed) algorithm is described that plans a course of motion with the minimum number of moves for an arm, with a mixed end, moving the obstacle-free plane so that the free end reaches a specified point. Dissert. Abstr.

N86-17002 British Library Lending Div., Boston Spa (England).
EXPERIENCE IN USING INDUSTRIAL ROBOTS AND AUTOMATIC MANIPULATORS
I. G. Barantsov, V. V. Vdovichenkov, and N. L. Dubinenko 1985 7 p Transl. into ENGLISH from Stal (USSR), no. 3, 1985 p 94-95
(BLL-M-36421-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Experience in the introduction and increasing use of robots and automatic manipulators at a tube works is presented. The manufacture of enamelled cooking utensils and galvanized pails, is used as examples. Author

N86-17003# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
CONSTRAINT-BASED SCHEDULING IN AN INTELLIGENT LOGISTICS SUPPORT SYSTEM: AN ARTIFICIAL INTELLIGENCE APPROACH Annual Report, 15 Mar. 1984 - 14 Mar. 1985
M. S. Fox and S. F. Smith 15 Jul. 1985 15 p
(Contract F49620-82-K-0017)
(AD-A159043; AFOSR-85-0720TR) Avail: NTIS HC A02/MF A01 CSCL 06/4

This report summarizes the progress of research performed under AFOSR contract Number F49620-82-K-0017, titled Constraint-Based Scheduling in an Intelligent Logistics Support Syestem: An Artificial Intelligence Approach . During the contract renewal period from March, 1984 to March, 1985, the continued development of a theory of hierarchical, opportunistic constraint-directed reasoning for job shop scheduling has been the focus of our research. Specifically, we have conducted work in the areas or of opportunistic exploitation of constraints, and constaint-directed diagnosis. The former has led us to the use of multiple problem decompositions during schedule generation, while the latter has evolved toward development of a more broad based framework for reactive scheduling. An experimental software system call ISIS has continued it evolution and additional testing with simulated plant data has been performed. The design of a successor system called PHOENIX has been initiated. Author (GRA)

N86-17004# Oak Ridge National Lab., Tenn.
ROBOT INVERSE DYNAMICS ON A CONCURRENT COMPUTATION ENSEMBLE
J. Barhen 1985 16 p Presented at ASME International Computers in Engineering Conference and Exhibition, Boston, Mass., 4 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016306; CONF-850862-5) Avail: NTIS HC A02/MF A01

Advances in VLSI technology provide a strong incentive to configure the "brain" of future intelligent robots as concurrent computation ensembles. The design of real-time operating systems for such machines is an important objective of the CESAR program. This paper addresses the development of ROSES, a prototype software system intended to provide expert scheduling capabilities in mapping precedence-constrained task graphs onto a computation ensemble. This problem being strongly NP-completee, ROSES attempts to achieve near-optimal solutions by combining heuristic techniques (to handle time complexity) with special instances of abstract data structures (to handle space complexity). The technique is applied to the solution of the inverse dynamics equations of a robot arm and achieves high efficiency and proper load balance. Critical concepts in the longer-term development of a Virtual Time Intelligent Machine Operating System (IMOS/VT) are also discussed. DOE

N86-17005# Oxford Univ. (England). Dept. of Engineering Science.
SELF-TUNING CONTROL OF A DIFFICULT PROCESS

D. W. Clarke, P. S. Tuffs, and C. Mohtadi 1984 19 p refs
(OUEL-1550/84) Avail: NTIS HC A02/MF A01

A universal self tuning control method called Generalized Predictive Control (GPC) is assessed by comparative simulation to show its superiority over generalized minimum variance, LQG, and pole-placement self-tuning algorithms. The simulations demonstrate that GPC is effective and robust for a range of typical plant models without the restrictions imposed by the other methods, and it is capable of good control of particularly difficult processes such as nonminimum-phase oscillators. Author (ESA)

N86-17006# Oxford Univ. (England). Dept. of Engineering Science.
AN H-INFINITY-MINIMAX APPROACH TO THE DESIGN OF ROBUST CONTROL SYSTEMS. PART 2: ALL SOLUTIONS, ALL-PASS FORM SOLUTIONS AND THE BEST SOLUTION
Yung Kuan Foo and Ian Postlethwaite 1985 21 p refs
(OUEL-1585/85-Pt-2) Avail: NTIS HC A02/MF A01

All solutions to a robustness optimization problem are characterized as the solutions of a two-parameter interpolation problem. From this characterization it is shown that an all-pass form solution always exists as long as a solution exists. The possibility of using non all-pass form solutions is studied, and by introducing other optimization objectives (motivated by improvements in disturbance rejection and robust stability) the best solution is sought.
Author (ESA)

N86-17007# Oxford Univ. (England). Dept. of Engineering Science.
MULTIVARIABLE CONTROL
Ian Postlethwaite 1985 22 p refs
(OUEL-1589/85) Avail: NTIS HC A02/MF A01

Multivariable control is introduced with an example (a helicopter model) to illustrate what is meant by a multivariable system and how such systems are modeled. The primary objectives of control and the feedback configurations which can be used to achieve them are discussed. Analysis techniques for assessing the significant properties of a control system design are summarized. Design methods for multivariable systems, and implications of digitally implemented controllers are reviewed. Author (ESA)

N86-17008# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
A POINT SET MODEL OF THE NONDETERMINISTIC REPETITIVE CONSTRUCT
Wim H. Hesselink Nov. 1984 11 p refs
(CS-8501) Avail: NTIS HC A02/MF A01

A translation in set theoretic terms of Dijkstra-Scholten's results of the operational interpretation of extrema solutions is given. The criteria of weakest precondition and weakest liberal precondition are studied. A postulate of Dijkstra is reported. A point set of the nondeterministic repetitive construct is developed. Author (ESA)

N86-17009# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
AUCTIONS AND FAIR DIVISION
Eric vanDamme 1984 25 p refs
(Rept-84-50) Avail: NTIS HC A02/MF A01

The situation in which a single indivisible object has to be divided among a group of persons who claim equal rights to that object is considered. An auction is used to allocate the object and the proceeds of the auction are divided equally among the participants. This procedure gives rise to a game with incomplete information, of which it is shown that it has exactly one symmetric Nash equilibrium. An explicit formula for this equilibrium is derived and its properties are studied. It is shown that this method has serious drawbacks, since it can produce results that are not envy free, i.e., results in which one of the players prefers another's allocation to his own. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-17010 California Univ., Irvine.
THE FINITE ELEMENT ANALYSIS OF ELECTROMECHANICAL DEVICES WITH ANISOTROPIC PERMANENT MAGNETS Ph.D. Thesis
Magdy Mohammed Saeb 1985 128 p
Avail: Univ. Microfilms Order No. DA8516555

Finite element analysis is applied to solve the Poisson equation for a stationary magnetic field in an anisotropic and saturable magnetic medium typically encountered in electromechanical devices with anisotropic permanent-magnets. Finite element equations were formulated using a weighted residual standard Galerkin method. The Galerkin method is proved, through the application of certain theorems found in the literature, to be more general in nature than the Rayleigh-Ritz method. Dissert. Abstr.

N86-17011 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
PIECEWISE CHEBYSHEV SERIES
M. G. Cox Jul. 1985 13 p refs
(NPL-DITC-63/85; ISSN-0262-5369) Copyright. Avail: Issuing Activity

Piecewise Chebyshev series for curve-fitting applications are discussed in respect of their historical role as a transition from the (whole range) Chebyshev series studied by Clenshaw, et al, in the 1950s and 1960s to the B-spline series used today.
Author (ESA)

N86-17012*# Maryland Univ., College Park. Dept. of Civil Engineering.
APPLICATION OF A STOCHASTIC SNOWMELT MODEL FOR PROBABILISTIC DECISIONMAKING Final Report
Richard H. McCuen Nov. 1983 45 p refs
(Grant NAG5-223)
(NASA-CR-177828; NAS 1.26:177828) Avail: NTIS HC A03/MF A01 CSCL 12A

A stochastic form of the snowmelt runoff model that can be used for probabilistic decision-making was developed. The use of probabilistic streamflow predictions instead of single valued deterministic predictions leads to greater accuracy in decisions. While the accuracy of the output function is important in decision-making, it is also important to understand the relative importance of the coefficients. Therefore, a sensitivity analysis was made for each of the coefficients. Author

N86-17013# National Aerospace Lab., Tokyo (Japan).
GRID GENERATION BASED ON PANEL METHOD
Masashi Shigemi 1985 29 p refs In JAPANESE; ENGLISH summary
(NAL-TR-860; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

A method of grid generation around an obstacle is proposed. The obstacle is assumed to be in a potential flow, which is readily analyzed by the panel method. Grids are made up by drawing stream lines and equi-potential lines, and therefore, they are naturally body-fitted and orthogonal. Calculation of the potential which is induced by vortices is explained in some detail, since it often becomes the major source of errors in the application of this method. The grid, of either H-type or O-type, is generated by assuming the corresponding potential flow around the obstacle. The C-type grid can also be obtained as a particular case of the O-type grid. Further application of this method includes generation of grids which cover a region whose outer boundary is assigned, and the region around multi-element obstacles. Author

N86-17014*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMULATION OF ROTOR-STATOR INTERACTION USING THE EULER EQUATIONS AND PATCHED GRIDS
Man Mohan Rai (Informatics General Corp.) Dec. 1985 10 p

refs
(NASA-TM-86821; A-85376; NAS 1.15:86821) Avail: NTIS HC A02/MF A01 CSCL 12A

An unsteady Euler code to study rotor-stator interaction problem was developed. The code uses patched grids that move relative to each other to simulate the motion of the rotor airfoils with respect to the stator airfoils. The Osher integration scheme is used in conjunction with an implicit relaxation approach. The scheme is second order accurate in space and time, and is also TVD in each spatial direction. The numerical results were found to be periodic in time, thus demonstrating the capability of the integration and zonal schemes in simulating periodic time dependent flow. The pressure contours obtained are almost oscillation free because of the TVD nature of the scheme. A new procedure was developed to simulate flows about bodies that move relative to each other. This capability should prove to be very useful in the areas of rotor-stator interaction, propeller-nacelle interaction, and helicopter rotor-fuselage interaction. Author

N86-17015# Naval Surface Weapons Center, Dahlgren, Va.
POWER SERIES SOLUTIONS FOR SLOWLY ROTATING POLYTROPES USING THE METHOD OF FROBENIUS Final Report
A. D. Parks Oct. 1984 22 p
(AD-A157867; AD-F350037; NSWC/TR-84-351) Avail: NTIS HC A02/MF A01 CSCL 12/1

The differential equations governing the structure of slowly rotating polytropes are derived and power series solutions to them are developed. Convergence characteristics of the series solutions are discussed and radii of convergence estimated. GRA

N86-17016# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
A MODELESS CONVEX HULL ALGORITHM FOR SIMPLE POLYGONS Interim Report
M. A. Peshkin and A. C. Sanderson May 1985 13 p
(AD-A159119; CMU-RI-TR-85-8) Avail: NTIS HC A02/MF A01 CSCL 12/1

This document presents an order n algorithm which computes the convex hull of a two-dimensional non-self-intersecting polygon. The algorithm recovers much of the simplicity of the one presented by Sklansky and subsequently disproved. Unlike several algorithms which have been found since then, the modified algorithm executes a truly uniform (modeless) traversal of all the vertices of the polygon. This makes it possible to extend the algorithm to extract geometric information about the interior of the polygon. GRA

N86-17017# National Opinion Research Center, Chicago, Ill.
FULL-INFORMATION ITEM FACTOR ANALYSIS Final Report
R. D. Bock, R. Gibbons, and E. Muraki Aug. 1985 72 p Prepared in cooperation with Educational Testing Service, Princeton, N.J.
(Contract N00014-83-C-0283; NR Proj. F63-521)
(AD-A159135) Avail: NTIS HC A04/MF A01 CSCL 12/1

A method of item factor analysis based on Thurstone's multiple factor model and implemented by marginal maximum likelihood estimation and the EM algorithm is described. Statistical significance of successive factors added to the model is tested by the likelihood ratio criterion. Provisions for effects of guessing on multiple choice items, and for omitted and not reached items, are included. Bayes constraints on the factor loadings are found to be necessary to suppress Heywood cases. Numerous applications to simulated and real data are presented to substantiate the accuracy and practical utility of the method. Analysis of the power tests of the Armed Services Vocational Aptitude Battery shows statistically significant departures from unidimensionality in five of the eight tests. Author (GRA)

N86-17018# North Carolina State Univ., Raleigh.
FAST ALGORITHMS FOR STRUCTURAL OPTIMIZATION, LEAST SQUARES AND OTHER COMPUTATIONS Final Report, 15 Jul. 1984 - 14 Jul. 1985
R. J. Plemmons 19 Jul. 1985 8 p
(Grant AF-AFOSR-0255-83)
(AD-A159136; AFOSR-85-0714TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Fast algorithms for solving large-scale structural optimization and least squares problems are being investigated. An especially significant aspect of this work is the development and testing of parallel algorithms for alternatives to the often ill-conditioned stiffness equations approach in structural analysis on machines such as the Cray X-MP, the Denelcor HEP and the Intel Hypercube. The principal thrusts in this project on least squares methods have been in developing techniques for the solution of superlarge problems in a stable way, i.e., employing orthogonal factorization techniques, on multiprocessors. These computations involve various levels of parallelism, including domain decomposition as well as pipelining type schemes for orthogonal factorization.
Author (GRA)

N86-17019# Stanford Univ., Calif. Lab. for Computational Statistics.
FULLY NONPARAMETRIC EMPIRICAL BAYES ESTIMATION VIA PROJECTION PURSUIT
M. V. Johns Aug. 1985 19 p
(Contract N00014-83-K-0472)
(AD-A159273; AD-E301788; LCS-TR-16) Avail: NTIS HC A02/MF A01 CSCL 12/1

The fully nonparametric formulation of the empirical Bayes estimation problem considers m populations characterized by conditional (sampling) distributions chosen independently by some unspecified random mechanism. No parametric constraints are imposed on the family of possible sampling distributions or on the prior mechanism which selects them. The quantity to be estimated subject to squared-error loss for each population is defined by a functional T(F) where F is the population sampling cdf. The empirical Bayes estimator is based on n iid observations from each population where $n > 1$. Asymptotically optimal procedures for this problem typically employ consistent nonparametric estimators of certain nonlinear conditional expectation functions. In this study a particular projection pursuit algorithm is used for this purpose. The proposed method is applied to the estimation of population means for several simulated data sets and one familiar real world data set. Certain possible extensions are discussed.
Author (GRA)

N86-17020# Yale Univ., New Haven, Conn. Dept. of Computer Science.
ON THE SOLUTION OF A CLASS OF TOEPLITZ SYSTEMS
M. Chen Aug. 1985 16 p
(Contracts N00014-82-K-0814; DE-AC02-81ER-10996)
(AD-A159313; Yaleu/DCS/RR-417) Avail: NTIS HC A02/MF A01 CSCL 12/1

The solution of certain Toeplitz linear systems is considered in this paper. This kind of system is encountered when we solve certain partial differential equations by finite difference techniques and approximate functions using higher order splines. The methods presented here are more efficient than the Cholesky decomposition method and are based on the circulant factorization of the banded circulant matrix, the use of the Woodbury formula and algebraic perturbation method. Author (GRA)

N86-17021 Admiralty Marine Technology Establishment, Teddington (England).
GREEN'S FUNCTIONS OF THE REDUCED WAVE EQUATION BETWEEN PARALLEL PLANES
E. A. Skelton Apr. 1985 18 p refs
(AMTE(N)-TM85023; BR96421) Copyright. Avail: NTIS HC A02/MF A01

The Green's functions in the region between planes on which either Neumann or Dirichlet boundary conditions apply are obtained in the form of double Fourier series expansions. A closed form expression for the sound field in an axisymmetric water filled channel is obtained to illustrate the usefulness of the expansions. Problems associated with numerical evaluation are discussed and numerical examples are given. Author (ESA)

N86-17022# Argonne National Lab., Ill.
SOME REMARKS ON INVERSES OF SPARSE MATRICES
I. S. Duff, A. M. Erisman, C. W. Gear, and J. K. Reid Apr. 1985 11 p
(Contracts W-31-109-eng-38; DE-AC02-76ER-02383)
(DE85-015509; ANL/MCS-TM-51) Avail: NTIS HC A02/MF A01

We discuss some properties of the structure of the inverse of a sparse matrix. In particular, we show that the structural inverse of an irreducible sparse matrix is always full. We first show that Gaussian elimination always yields a full structural inverse and then show the result directly. We believe that our lemmas concerning Gaussian elimination are of interest in their own right. DOE

N86-17023# Los Alamos National Lab., N. Mex.
CAN MATHEMATICS EXPLAIN NATURAL INTELLIGENCE
J. Mycielski Jul. 1985 15 p
(Contract W-7405-eng-36)
(DE85-017948; LA-10492-MS) Avail: NTIS HC A02/MF A01

The author discusses four algorithms that have one thing in common with the brain; they learn to predict future events based on past experience. The first is the classical predictor x(sub t+h) + 3x(sub t) - 3x(sub t-h) + x(sub t-2h) for the values of a quadratic progression. The second predicts the values of linear functionals. The third predicts the vector outputs of an orthogonal operator. The fourth predicts the letters or morphemes of a text. The first, second, and fourth are simple enough so that mechanisms appropriate for the computations that they require could exist in our brains. The author proves estimates of the sum of the absolute squares of errors for the second and third algorithm. DOE

N86-17024# Brookhaven National Lab., Upton, N. Y.
GEOMETRY OF CHAOS
H. B. Stewart 14 Nov. 1984 26 p
(Contract DE-AC02-76CH-00016)
(DE85-016199; BNL-51892) Avail: NTIS HC A03/MF A01

Signals or measurements of chaotic dynamics have some aspect which passes every test for randomness: in this aspect chaos is as random as a coin toss. The evidence that such randomness can ocurr in simple deterministic dynamical systems has been accumulating over the past twenty years at an accelerating pace. The word chaos was first attached to this phenomena just ten years ago. The impact of this discovery could potentially touch every scientist concerned with understanding dynamic phenomena. To the pessimist it implies that even simple dynamical systems are unpredictable in detail except for the very short run. To the optimist, it means that an observed dynamic behavior which passes the strongest test for randomness may still have a simple explanation. Among the irregular behaviors which might be explained by deterministic dynamic models are a poorly tuned car engine, population fluctuations in an ecosystem of competing species, turbulence in fluids such as the oceans or the atmosphere, arrhymthia or fibrillation in a beating heart, a dripping faucet, and growth cycles in a national economy. DOE

N86-17025# California Univ., Berkeley. Lawrence Berkeley Lab.
NUMERICAL SOLUTION OF BOUNDARY CONDITION TO POISSON'S EQUATION AND ITS INCORPORATION IN THE PROGRAM POISSON
S. Caspi, M. Helm, and L. J. Laslett May 1985 6 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-016637; LBL-19483; CONF-850504-246) Avail: NTIS HC A02/MF A01

Two dimensional cartesian and axially-symmetric problems in electrostatics or magnetostatics frequently are solved numerically by means of relaxation techniques - employing, for example, the program POISSON. In many such problems the sources (charges or currents, and regions of permeable material) lie exclusively within a finite closed boundary curve and the relaxation process in principle then could be confined to the region interior to such a boundary - provided a suitable boundary condition is imposed onto the solution at the boundary. This paper discusses and illustrates the use of a boundary condition of such a nature in order thereby to avoid the inaccuracies and more extensive meshes present when alternatively a simple Dirichlet or Neumann boundary condition is specified on a somewhat more remote outer boundary. DOE

N86-17026# Sandia National Labs., Albuquerque, N. Mex.
MODEL RANDOMNESS INDUCED BY BOUNDARY CONDITIONS
T. L. Paez, L. J. Branstetter, and D. L. Gregory 1985 8 p Presented at the SAE Aerospace Technology Conference and Exposition, Long Beach, Calif., 14 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE85-016999; SAND-85-0953C; CONF-8510150-1) Avail: NTIS HC A02/MF A01

The modal frequencies of a structure often exhibit random variation. This variation may be an important factor affecting structural response. This paper summarizes the results of a combined experimental and analytical study that considers modal frequency randomness arising from boundary condition random variation. It is shown that a simple measure of boundary condition characteristics can be used in connection with a finite element based analysis to estimate random variation in modal frequencies. A comparison between the experiment and the analysis confirms the accuracy of the analytical technique. DOE

N86-17027# Bettis Atomic Power Lab., West Mifflin, Pa.
RELAXATION PARAMETERS FOR THE IQE ITERATIVE PROCEDURE FOR SOLVING SEMI-IMPLICIT NAVIER-STOKES DIFFERENCE EQUATIONS
J. H. Anderson and L. A. Hageman Jun. 1985 21 p Presented at the Westinghouse Engineering Computer Applications Symposium, Monroeville, Pa., 7 Oct. 1985
(Contract DE-AC11-76PN-00014)
(DE85-017632; WAPD-T-2867; CONF-8510149-1) Avail: NTIS HC A02/MF A01

Numerical solutions of the time-dependent Navier-Stokes equations for a thermally expandable fluid require advancing the unknown flow variables in time by either an implicit, a semi-implicit, or an explicit procedure. Explicit methods require a modest amount of computational effort per time step but require excessively small timestep lengths to ensure numerical stability. On the other hand, implicit and semi-implicit schemes allow the use of large timestep lengths but suffer from increased computational complexities. Fully-implicit methods generate coupled systems of nonlinear equations that must be solved at each point in time, whereas semi-implicit procedures generate coupled systems of linear equations. The focus of this paper is on the use of a recently formulated iterative procedure, called the IQE method, for solving the linear systems produced by a semi-implicit method. The IQE method, for solving the linear systems produced by a semi-implicit method. The IQE method requires the use of a relaxation parameter (LC omega) which must be properly chosen to obtain the greatest rate of convergence. Using heuristic arguments, we develop a numerical procedure for estimating near-optimal values of (LC omega). Numerical test results are included. DOE

N86-17028# Bettis Atomic Power Lab., West Mifflin, Pa.
EFFICIENT ITERATIVE PRESSURE SOLUTION METHOD FOR TIME-DEPENDENT FLUIDS COMPUTATIONS
L. A. Hageman, M. M. Sussman, and B. E. Wiancko Jun. 1985 21 p Presented at the Westinghouse Engineering Computer Applications Symposium, Monroeville, Pa., 7 Oct. 1985
(Contract DE-AC11-76PN-00014)
(DE85-017633; WAPD-T-2868; CONF-8510149-5) Avail: NTIS HC A02/MF A01

Three-dimensional transient incompressible fluid flow computations at Bettis involve solution of a discrete Poisson equation for the pressure variable at each time level. The matrix coefficients depend only on the geometry and boundary conditions and do not change from timestep to timestep; however, the right hand side does change every timestep. Large numbers of timesteps

are anticipated. Iterative methods are necessary because of the size of the matrix problem. One purpose of this paper is to present alternative solution methods for the pressure variable. The candidate methods are judged on the basis of their suitability for efficient implementation on a vector processor and the potential for overlapping data transfer to and from disk with computation by the central processing unit. The most suitable method is the block red-black cyclic Chebyshev semi-iterative method. Another purpose of this paper is to discuss the implementation of the Chebyshev method. Considered are such topics as the selection of nearly optimal iteration parameters, monitoring of iteration data as the timesteps progress, the behavior of the iterations in reaching a steady solution (treated as a long time limit of a transient), and efficient vectorization for the Cyber-205 computer. Numerical results of tests of the methods will be presented. DOE

N86-17029# Lawrence Livermore National Lab., Calif.
SHAPE PRESERVING INTERPOLATION, REVISION 1
R. E. Carlson Aug. 1985 15 p Presented at the Institute of Mathematics and Its Applications: Conference on Algorithms for the Approximation of Functions and Data, Swindon, Engl., 15 Jul. 1985
(Contract W-7405-eng-48)
(DE85-016947; UCRL-92986-Rev-1; CONF-850793-1-Rev-1) Avail: NTIS HC A02/MF A01

Fast, accurate interpolation algorithms are needed in virtually all areas of high speed scientific computing. As computer power has grown, physical, mathematical and computational models have become more complicated in an attempt to achieve more realistic simulations of the underlying physical processes. In the past an important criterion used to select an interpolation algorithm was the accuracy of a method as measured by the rate of convergence of the interpolant as the mesh size is decreased to zero. In attempting to increase fidelity to underlying physical processes, two phrases have come into vogue when describing interpolation methods: visually pleasing and shape preserving. Shape preserving refers to the preservation of one or more mathematical properties (called shape characteristics) during the interpolation process. These shape characteristics often represent physical properties of the system being modeled. This paper is about shape preserving interpolation methods as applied to solving real-world scientific problems. DOE

N86-17030# Washington Univ., Seattle. Dept. of Physics.
LOW-ENERGY LIMIT OF STRINGS
R. I. Nepomechie Jul. 1985 20 p
(Contract DE-AC06-81ER-40048)
(DE86-000541; DOE/ER-40048/21-P5) Avail: NTIS HC A02/MF A01

We investigate terms with four derivatives in the low-energy action of closed Bose strings. Our analysis is consistent with the possibility that the action involves only curvatures of an affine connection with torsion. The torsion is provided by the antisymmetric tensor gauge field. DOE

N86-17031# Rome Univ. (Italy). Dipt. di Fisica.
A CLASS OF SOLVABLE DYNAMICAL SYSTEMS
F. Calogero 4 Feb. 1985 19 p refs Presented at International Conference on Solitons and Coherent Structures, Santa Barbara, Calif., 11-16 Jan. 1985 Submitted for publication Sponsored by Italian Ministry of Public Education
(Preprint-439) Avail: NTIS HC A02/MF A01

A large class of integrable dynamical system which can be identified to n quantities X evolving in time according to an appropriate system of n coupled nonlinear ordinary differential equations with n zeros of a polynomial in X corresponding to a linear partial differential equation (PDE), is studied. The fact that this polynomial can be interpreted as solution of the linear second-order PDE and the corresponding evolution equations for the zeros of a polynomial, are discussed. The integrability of these dynamical system is demonstrated by exhibiting an explicit nonlinear mapping which is related to linear second-order PDE depending of zeros of a polynomial. A list of explicit examples of dynamical systems contained in this class is given. Author (ESA)

N86-17032# Fondazione Ugo Bordoni, Rome (Italy).
HARMONIC RETRIEVAL BY SIMULTANEOUS APPLICATION OF BURG'S AND PISARENKO'S METHODS
Giuseppe Martinelli (Rome Univ.), Gianni Orlandi (Rome Univ.), and Mario Salerno (Rome Univ.) Dec. 1983 11 p refs Sponsored by Ist. Superiore delle Poste e delle Telecomunicazioni
(FUB-53-1983) Avail: NTIS HC A02/MF A01

Parameter estimates for sinusoidal signals in additive noise for short data lengths is discussed. An approximate relation between the polynomials obtained by the constrained predictor and by Pisarenko's (1973) method is derived. This relation allows harmonic retrieval of the process using only Burg's (1975) method. The resulting algorithm is very efficient in terms of computational cost and accuracy. Author (ESA)

N86-17033# Fondazione Ugo Bordoni, Rome (Italy).
A NOTE ON THE REPRESENTATION OF INTEGERS AS A SUM OF DISTINCT FIBONACCI NUMBERS
Piero Filipponi Jan. 1985 12 p refs Sponsored by Ist. Superiore delle Telecomunicazioni
(FUB-1-1985) Avail: NTIS HC A02/MF A01

The fact that every positive integer can be represented uniquely as finite sum of distinct nonconsecutive Fibonacci numbers (F-addends), is considered. The asymptotic value of the average of F-addends and the probable least upper bound of F-addends, are given. The greatest lower bound of F-addends and the bound of the number of integers which are representables as F-addends, are estimated. Author (ESA)

N86-17034# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Statik.
THE USE OF FUNDAMENTAL SOLUTIONS OF LINEAR ELASTOSTATICS AS STARTING FUNCTIONS FOR THE CALCULATION OF HYBRID DISK AND BODY ELEMENTS Ph.D. Thesis [ZUR VERWENDUNG VON FUNDAMENTALLOESUNGEN DER LINEAREN ELASTOSTATIK ALS ANSATZFUNKTIONEN BEI DER BERECHNUNG HYBRIDER SCHEIBEN- UND KOERPERELEMENTE]
H. Zwanzger 1984 81 p refs In GERMAN
(Rept-3; D-17) Avail: NTIS HC A05/MF A01

A method for the establishment of stiffness matrices of finite disk and body elements with an arbitrary number of nodes, allowing in an extreme case to form a wing unit by a single element, is presented. Fundamental solutions of linear elastostatics were chosen as starting functions; they allow optimum freedom in the modeling of hybrid elements. The element stiffness matrices were obtained by variational calculus. The operational calculus theory in the function domain was applied for the interpretation of numerical phenomena. The disk and body elements were checked by modeling of typical rod statistics problems in two and three-dimensional structures. The possibility of hybrid macroelements to reproduce even complex stress fields is demonstrated by disk examples. Investigation of regular and singular fundamental solutions in connection with arbitrarily precise macroelements establishes a steady transition between the finite element method and the boundary element method. The numerical calculation shows that the singular fundamental solutions applied in the boundary element method can be completed by suited regular fundamental solutions. Author (ESA)

N86-17035# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
A THEORY OF NONDETERMINISTIC DATA STRUCTURES
Wim H. Hesselink Feb. 1985 57 p refs
(CS-8503) Avail: NTIS HC A04/MF A01

A theory of data structures, in which correctness of an implementation can be formally verified, without imposing irrelevant restrictions to implementations, was developed using set theory. In order not to be forced to specify all details of an implementation, nondeterminism on the formal level is admitted,

particularly nondeterministic occurrences of error and overflow conditions. Error is introduced as a universal outlet after which the specifications fail. It turns out that axiomatic characterizations of data structures are completely undisturbed by the nondeterminism. The initial algebras lose their prerogatives. The universal models may be considered as terminal algebras. Author (ESA)

N86-17036# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE ODD-EVEN HOPSCOTCH SCHEME FOR THE NUMERICAL INTEGRATION OF TIME-DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS
J. H. M. tenThijeBoonkkamp and J. G. Verwer Jun. 1985 19 p refs Submitted for publication
(CWI-NM-R8513; B8569860) Avail: NTIS HC A02/MF A01

Via the equivalence to the combined leapfrog-Du Fort-Frankel method, the explicit expression of the critical time step for von Neumann stability for a class of multidimensional convection-diffusion equations is derived. This expression can be derived directly by applying a stability theorem due to Hindmarsh, et al, (1984). The time step is independent of the diffusion parameter and yet smaller than the critical time step for zero diffusion, but only in the multidimensional case. This phenomenon does not occur for the one-dimensional problem. The Du Fort-Frankel accuracy deficiency of the hopscotch scheme is overcome by global Richardson extrapolation in time. This device can always be used without reducing feasibility. Numerical examples to illustrate the outcome of the extrapolation are given. Author (ESA)

N86-17037# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
A GEOMETRIC APPROACH TO THE SINGULAR FILTERING PROBLEM
J. M. Schumacher Mar. 1985 18 p refs Submitted for publication
(CWI-OS-R8502; B8569335) Avail: NTIS HC A02/MF A01

The least-squares filtering problem for a stationary Gaussian process when the observation is not fully corrupted by white noise, the so-called singular case is studied. An optimal estimator is constructed consisting of an integrating part, which is, as in the regular case, computed from a spectral factorization or an equivalent matrix problem, and a differentiating part whose parameters are computed from a single matrix equation. This improves on older results which either work under restrictive assumptions, or describe the solution only as the result of a nested algorithm. Author (ESA)

N86-17038# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
GENUINELY POLYNOMIAL SIMPLEX AND NONSIMPLEX ALGORITHMS FOR THE COST FLOW PROBLEM
J. B. Orlin (MIT, Cambridge) May 1985 41 p refs
(Grant N00014-83-K-0220)
(CWI-OS-R8504; B8569337) Avail: NTIS HC A03/MF A01

Three algorithms for the minimum cost network flow problem are given. Two are genuinely polynomial dual simplex algorithms for the minimum cost network flow problem. The dual simplex algorithms presented are simplex pivot rules provably polynomial for the cost network flow problem. The fact that Edmond-Karp's method can be interpreted as the number of arithmetic operations which is independent of BIT(b) or BIT(c), is proved. A computational bound for the minimum cost network flow problem for sparse networks is given. Author (ESA)

N86-17039# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
CONTINUATION AND NODAL PROPERTIES OF SOLUTIONS OF AN EIGENVALUE PROBLEM FOR ROTATING RODS
Ph. Clement and J. Descloux (Ecole Polytechnique Federale de Lausanne, Switzerland) 1984 39 p refs
(Rept-84-51) Avail: NTIS HC A03/MF A01

A nonlinear eigenvalue problem with boundary conditions is considered. A correct proof of the existence of trivial solutions for the integro-differential equation corresponding to Odeh-Tadjbakhsh's problem is given and one sentence of a nontrivial solution to Odeh-Tadjbakhsh's problem is proved. The fact that secondary bifurcations occur on the branches emanating from conditions of nonlinear eigenvalue problems related with Odeh-Tadjbakhsh's conjecture is discussed. Author (ESA)

N86-17040# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
SOME LIMIT RESULTS FOR AN ENERGY STORAGE MODEL
G. Hooghiemstra and C. L. Scheffer 1985 11 p refs
(Rept-85-01) Avail: NTIS HC A02/MF A01

The behavior of the stationary distribution of the temperature level in a tank used for the storage of solar energy is discussed. The fact that the Daley-Deng Conjecture is true, is proved. This solution is not so nice for practical applications since a Laplace Transform has to be inverted numerically. Limit results for an energy storage model are given. Author (ESA)

N86-17041# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
CYCLONOMIAL COEFFICIENTS, PROPERTIES AND APPLICATIONS [CYCLONOMIALE COEFFICIENTEN, ENGENSCHAPPEN EN TOEPASSINGEN]
A. Snijders and C. Roos 1985 22 p ref In DUTCH
(Rept-85-11) Avail: NTIS HC A02/MF A01

Cyclonomial coefficients for the generation in lexicographic order of numbers for which the sum of the figures is constant were studied. Cyclonomial coefficients which are generalized binomial coefficients, are introduced. It is shown that every natural number can be represented as a sum of cyclonomial coefficients. This representation was used to number words successively in a so-called constant weight code. The resulting natural ordering of words proves to coincide with the usual lexicographic ordering. Author (ESA)

N86-17042# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
APPLICATION OF FINITE ELEMENTS TO SOLID GEOMETRY MODELING
C. D. Balch 1983 12 p refs
(Lab-Rept-752) Avail: NTIS HC A02/MF A01

A method of representing solids, based on a cell decomposition scheme in which the cells are taken to be finite elements with curved edges and faces is discussed. Object geometry is described by a finite element mesh, and simple geometric problems of surface contact and interference are solved. The method can be used with conventional finite element analysis procedures. Complex geometric forms with curved surfaces can be represented by a relatively small number of cells. The equations of cell (element) edges and faces can be cast in simple parametric form, enabling the implementation of the analytical approaches to be discussed. It is shown that isoparametric elements with curved edges can be applied to the solution of point inclusion in a solid and edge intersection. Computer implementations which utilize an interactive graphics system are described. Author (ESA)

N86-17043# National Center for Atmospheric Research, Boulder, Colo.
RECONSTRUCTING A FUNCTION BY CIRCULAR HARMONIC ANALYSIS OF ITS RADON TRANSFORM
R. M. Perry May 1985 27 p Sponsored in part by NSF, Washington, D.C.
(PB85-212322; NCAR/TN-255+STR) Avail: NTIS HC A03/MF A01 CSCL 12A

The image reconstruction problem in the standard two-dimensional case is determining a function f at each point the plane given the integrals of f along all straight lines in the plane. The integrals of f along straight lines comprise the Radon transform of f, a function defined for parametric coordinates denoting line orientations in the plane. The reconstruction problem obtains the

function f as a circular-harmonic expansion in polar coordinates, f(r, theta) = Summation (f sub m)(r)(e sup im(theta)), from a corresponding expansion of the Radon transform, g(s,phi) = Summation (g sub m)(s)(e sup iom(phi)) is considered. An integral transform giving each harmonic (f sub m) of the function f in terms of the corresponding harmonic (g sub m) of the Radon transform g is derived. The basis of a technique for reconstructing the function f as an expansion in the Fourier components (f sub m)(r)(e sup im(theta)), is obtained from the corresponding harmonics (g sub m) which are obtainable by Fourier analysis of the Radon transform g. GRA

N86-16575# Joint Publications Research Service, Arlington, Va.
GEOMETERIC DEFINITION OF UNIFORM B-SPLINE CURVES
Shi Fazhong *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 34-44 refs Transl. into ENGLISH from Shuzhi Jisuan yu Jisuanji Yingyong (Beijing, China), v. 6, no. 1, Mar. 1985 p 49-56 (For primary document see N86-16573 07-36)
Avail: NTIS HC A07/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N86-17044# South Carolina Univ., Columbia. Dept. of Mathematics and Statistics.
NONPARAMETRIC METHODS FOR HAZARD RATE ESTIMATION FROM RIGHT-CENSORED SAMPLES
D. T. McNichols and W. J. Padgett Aug. 1985 21 p Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg
(Contract MIPR-ARO-139-85; Grant AF-AFOSR-0156-84)
(AD-A159131; TR-106; AFOSR-85-0691TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Nonparametric estimation of the hazard rate or failure rate is a frequent topic of investigation in the statistical literature because of its practical importance. Until quite recently, hazard rate estimation had been based on complete samples of independent identically distributed lifetimes. However, observations may be censored or truncated in many life testing situations. This occurs often in medical trials when the patients may enter treatment at different times and then either die from the disease under investigation or leave the study before its conclusion. A similar situation may occur in industrial life testing when items are removed from the test at random times for various reasons. It is of interest to be able to estimate nonparametrically the unknown hazard rate of the lifetime random variable from this type of data without ignoring or discarding the right-censored information. The purpose of this paper is to discuss nonparametric estimation of the hazard rate function for right-censored samples. The various types of estimators that have been proposed in the literature will be indicated and briefly discussed in Section 3. These include maximum likelihood estimators, kernel type estimators, Bayesian estimators, and histogram estimators. Due to their computational simplicity and other properties, the kernel-type hazard rate estimators will be emphasized. Results of Tanner (1983) and Tanner and Wong (1983, 1984) will be presented in Section 4 while the estimator considered by McNichols and Padgett (1981) will be discussed in Section 5. GRA

N86-17045# Oxford Univ. (England). Dept. of Engineering Science.
STATISTICAL BOUNDS ON MULTIVARIABLE FREQUENCY RESPONSE; AN EXTENSION OF THE GENERALIZED NYQUIST CRITERION
D. J. Cloud and B. Kouvaritakis May 1985 58 p refs
(OUEL-1581/85) Avail: NTIS HC A04/MF A01

Statistical bounds for model parameters and corresponding system frequency response limits are established. The results are extended to multivariable systems to produce an element by element characterization of system uncertainty. This uncertainty representation can be used to develop frequency response bounds on the eigenfunctions of perturbed multivariable systems, thus producing system gain and phase information via a generalized Nyquist analysis. An application of the technique using a two-input/two-output system is presented. Author (ESA)

N86-17046# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
MARKOV JUMP-DIFFUSSION MODELS AND DECISION-MAKING FREE FILTERING
H. A. P. Blom 24 Oct. 1983 22 p refs Presented at 6th International Conference on Analysis and Optimization of Systems, Nice, France, 19-22 Jun. 1984
(NLR-MP-83067-U; B8566529) Avail: NTIS HC A02/MF A01

Nonlinear filtering of Gaussian observations of a Markov jump-diffusion with an embedded Markov chain, that is described by Poisson measure is considered. The modeling potential of this class of Markov processes is illustrated by simple realistic examples. For the evolution of the conditional expectation of the Markov process, decomposed representations are given. They are used as a basis to obtain approximate filtering algorithms free of decision making mechanisms. The algorithms are discussed for the examples given. Author (ESA)

N86-17047# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
THE TOTAL TIME ON TEST PLOT AND THE CUMULATIVE TOTAL TIME ON TEST STATISTIC FOR A COUNTING PROCESS
R. D. Gill Mar. 1985 8 p refs
(CWI-MS-R8501; B8569329) Avail: NTIS HC A02/MF A01

Asymptotic null-hypothesis distribuition theory for the total time on test and the cumulative total time on test for a random stopped Poisson process with constant intensity, is developed. Large versions of the total time test plot and statistic for Brownian bridge, are given. Author (ESA)

N86-17048# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
ON ESTIMATING TRANSITION INTENSITIES OF A MARKOV PROCESS WITH AGGREGATE DATA OF A CERTAIN TYPE: OCCURRENCES BUT NO EXPOSURES
R. D. Gill Apr. 1985 26 p refs Submitted for publication
(CWI-MS-R8502-Rev; B8569330-Rev) Avail: NTIS HC A03/MF A01

A specific form of aggregate data is used to study finite-state space time-homogeneous Markov processes applied to models of movement of individuals. A method of estimation of the underlying Markov processes is reported. Results on the properties of this method applied to demography are given. Author (ESA)

N86-17049# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
SOME CURRENT DEVELOPMENTS IN DENSITY ESTIMATION
Piet Groeneboom Jun. 1985 28 p refs
(CWI-MS-R8503; B8569331) Avail: NTIS HC A03/MF A01

The best performance expected from monoparametric density estimators according to the criterion of minimax risk, is discussed. The relations between the metric entropy (massivity of a set) of the set of densities and the rate of convergence to zero of the minimax risk, are discussed. These relations can be used in approximation theory of bonds and rate convergence for minimax risk. Properties of minimax risk, local asymptotic minimax risk, and the behavior of a density estimator, are given. Author (ESA)

N86-17050# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
A SIMPLE TEST OF THE PROPORTIONAL HAZARDS ASSUMPTION
R. D. Gill and M. Schumacher Jul. 1985 45 p refs Sponsored in part by Deutsche Forschungsgemeinschaft

(CWI-MS-R8504; B8569332) Avail: NTIS HC A03/MF A01

Proportional hazard test procedures based on the observation that in nonproportional hazards situations different two-sample tests, e.g., the logrank and a generalized Wilcoxon test, can produce very different answers are proposed. The procedures use this discrepancy as a check of the proportional hazards assumption, and are based on the relationship between generalized linear rank tests and estimates of the proportionality constant. This implies that the test statistics can be interpreted in a very natural way and almost all computational effort has to be done anyway. A graphical method for comparing trends in series of events is presented. Author (ESA)

N86-17051# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.

ON ASYMPTOTIC INFERENCE ABOUT INTENSITY PARAMETERS OF A COUNTING PROCESS

Kacha O. Dzhaparidze Jul. 1985 18 p refs Presented at International Statistics Institute Centenary Session, Amsterdam, 12-22 Aug. 1985 Submitted for publication

(CWI-MS-R8505; B8569333) Avail: NTIS HC A02/MF A01

The Cox regression model is extended to the stochastic processes theory with a filtration by which the probability measure is completly defined by a compensator of predictable characteristics particulars. The asymptotic stability properties conjecture is confirmed. A refined characterization of the properties is reported. Author (ESA)

N86-17052# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.

SILHOUETTES: A GRAPHICAL AID TO THE INTERPRETATION AND VALIDATION OF CLUSTER ANALYSIS

Peter J. Rousseeuw 1984 30 p refs

(Rept-84-41) Avail: NTIS HC A03/MF A01

A graphical display for nonhierarchical cluster analysis is proposed. Each cluster is represented by a so-called silhouette, which is based on the comparison of its tightness and separation. This silhouette shows which objects lie well within their cluster, and which are in between clusters. The entire clustering is displayed by combining the silhouettes into a single plot, allowing an appreciation of the relative quality of the clusters and an overview of the data configuration. The average silhouette width provides an evaluation of clustering validity, and can be used to select an appropriate number of clusters. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N86-17053# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.

THE COMPLEXITY OF DYNAMIC/PERIODIC LANGUAGES AND OPTIMIZATION PROBLEMS

J. B. Orlin May 1985 22 p refs

(CWI-OS-R8505; B8569338) Avail: NTIS HC A02/MF A01

A characterization of the class PSPACE as those languages L for which each element x of L has a periodic certificate is given. The characterization leads to proofs that a large number of NP-complete problems have dynamic/periodic counterparts that are PSPACE-complete. The characterization is also useful in analyzing periodic scheduling problems that arise in workforce planning, transportation planning, and operations management. Author (ESA)

N86-17054# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.

ENERGY MODELING WITH MULTIPLE OBJECTIVES AND MULTIPLE ACTORS

M. Kok 1984 20 p refs

(Rept-84-43) Avail: NTIS HC A02/MF A01

A linear programming model of the energy supply system in the Netherlands was extended to handle multiple objectives and multiple actors. The extension helps to determine the margin of energy policy (this includes tradeoff information). The optimal policies of actors and (interest) groups can be determined in a structured way. It is a supply-side model: the final demand of the sectors of the economy is given exogeneously. It is a partial equilibrium model: there is no feedback of the solution (e.g., consumption of natural gas, coal, etc.; investments; balance of trade) to a model of the remainder of the economy. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N86-17055# Department of Energy, Washington, D. C. Scientific Computing Staff.

SUMMARIES OF THE FY 1984 AND FY 1985 APPLIED MATHEMATICAL SCIENCES RESEARCH PROGRAM

Jul. 1985 54 p

(DE85-016240; DOE/ER-0240) Avail: NTIS HC A04/MF A01

The purpose of this report is to provide a convenient compilation of summaries of the individual research projects that constitute the Applied Mathematical Science research subprogram managed by the Director, Scientific Computing Staff, Office of the Director of Energy Research, Department of Energy. This new office, organized in 1984, consists of the applied mathematical sciences research activity formerly under the Division of Engineering, Mathematical Geosciences, Office of Basic Energy Science, Office of Energy Research, and the management of the expanded National Magnetic Fusion Energy Computer Network formerly under the Office of Magnetic Fusion Energy. DOE

N86-17056# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics.

WEAKLY COMPLETE CONES IN HARMONIC ANALYSIS [LES CONES FAIBLEMENT COMPLETS EN ANALYSE HARMONIQUE]

Erik G. F. Thomas 1984 18 p refs In FRENCH; ENGLISH summary

(ZW-8416) Avail: NTIS HC A02/MF A01

The cones of positive definite distributions from a Lie group are weakly complete and the union of metric caps. The Choquet method can then be applied to those cones, and to the convex sub-cones which are close. Classes such as the positive type central distribution play an important role in harmonic analysis. Theorems establishing these concepts are presented. Author (ESA)

N86-17057# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics.

AUTOMORPHISMS OF COMPLETE LOCAL RINGS HAVING A LOGARITHM

C. Praagman 1984 20 p refs Sponsored by Netherlands Foundation for Mathematics and Netherlands Organization for the Advancement of Pure Research, Amsterdam, Netherlands

(ZW-8417) Avail: NTIS HC A02/MF A01

The fact that the existence of an arbitary rational iteration group, which contains a given automorphism of a complete local ring is equivalent to the existence of a logarithm of the automorphism, is proved. The proof is based on the fact that an automorphism which has iterative roots of arbitrary order lies in the image of the exponential map. The image of this exponential map on a plane algebroid curve is discussed. Author (ESA)

N86-17058# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics.

ON A QUASI-PERIODIC HOPF BIFURCATION

B. L. J. Braaksma and H. W. Broer 1985 52 p refs

(ZW-8501) Avail: NTIS HC A04/MF A01

The differential equation of forced oscillators for small damping is studied. The quasi-periodic Hopf bifurcation for the model

problem of a quasi-periodic forced oscillator with fixed frequencies is reported as a solution of Stoker's problem. Author (ESA)

N86-17059# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
MULTIPLE GRID AND OSHER'S SCHEME FOR THE EFFICIENT SOLUTION OF THE STEADY EULER EQUATIONS
P. Hemker and S. P. Spekreijse Jun. 1985 25 p refs Submitted for publication
(CWI-NM-R8507; B8569856) Avail: NTIS HC A02/MF A01

An iterative method for the solution of the steady Euler equations for inviscid flow is developed. The system of hyperbolic conservation laws is discretized by a finite volume Osher-discretization. The iterative method is a multiple grid (FAS) iteration with symmetric Gauss-Seidel (SGS) as a relaxation method. Initial estimates are obtained by full multigrid. In the pointwise relaxation, the equations are kept in block-coupled form. Local linearization of the equations and the boundary conditions is considered. The efficient formulation of Osher's discretization of the 2D nonisentropic steady Euler equations and its linearization is presented. The efficiency of FAS-SGS iteration is shown for a transonic model problem. It appears that the rate of convergence is independent of the grid size and that for all mesh sizes the discrete system is solved up to truncation error accuracy in only two or three iteration cycles. Author (ESA)

N86-17060# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE ECONOMIZATION OF EXPLICIT RUNGE-KUTTA METHODS
B. P. Sommeijer Jun. 1985 20 p refs Submitted for publication
(CWI-NM-R8508; B8569857) Avail: NTIS HC A02/MF A01

A modification to explicit Runge-Kutta (RK) methods is proposed. Schemes which require less derivative-evaluations to achieve a certain order than classical RK methods are constructed. Examples of a second-order method requiring one evaluation, two third-order methods using one and two evaluations, and a fourth-order method which requires two evaluations are given. Numerical examples illustrate the behavior of the schemes. Author (ESA)

N86-17061# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
SPATIAL DISCRETIZATION OF HYPERBOLIC EQUATIONS WITH PERIODIC SOLUTIONS
P. J. vanderHouwen Jun. 1985 18 p refs Submitted for publication
(CWI-NM-R8514; B8569861) Avail: NTIS HC A02/MF A01

The Cauchy problem for hyperbolic equations for which the frequencies of the main Fourier components in the solution are located in a given frequency interval is investigated. Difference formulas for the spatial derivatives that are tuned to the given intervals of frequencies are constructed. Numerical examples illustrating the discretizations for linear and nonlinear problems are given. Author (ESA)

N86-17062# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE ZEROS OF THE RIEMANN ZETA FUNCTION IN THE CRITICAL STRIP: 4
J. vandeLune, H. J. J. teRiele, and D. T. Winter Jun. 1985 21 p refs
(CWI-NM-R8515; B8569862) Avail: NTIS HC A02/MF A01

The computation in order to show the first 1,500,000,001 zeros of Riemann's zeta function in the critical strip are simple and lie on the vertical with real part 1/2, are reported. The FORTRAN/COMPASS program for this computation was run on a CDC CYBER 175/750 computer to separate the zeros of zeta function in adequate intervals. The total CPU time used amounted to 900 hr on the CYBER 175/750 and 100 hr on the CYBER 205. Author (ESA)

N86-17063# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
STABILITY AND B-CONVERGENCE OF LINEARLY IMPLICIT RUNGE-KUTTA METHODS
W. H. Hundsdorfer Jul. 1985 20 p refs Submitted for publication
(CWI-NM-R8516; B8569863) Avail: NTIS HC A02/MF A01

Stability and convergence properties of linearly implicit Runge-Kutta methods applied to stiff semilinear systems of differential equations are studied. The stability analysis includes stability with respect to internal perturbations. All results are independent of the stiffness of the system. Author (ESA)

N86-17064# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
A STUDY OF B-CONVERGENCE OF RUNGE-KUTTA METHODS
K. Burrage (Auckland Univ., New Zealand), W. H. Hundsdorfer, and J. G. Verwer Jul. 1985 18 p refs
(CWI-NM-R8517; B8569864) Avail: NTIS HC A02/MF A01

The convergence analysis of implicit Runge-Kutta methods as applied to stiff, semilinear systems of the form $U(t)+g(t,U(t))$ is studied. A criterion which determines whether the order of optimal B-convergence is at least equal to the stage order or one order higher is developed. This criterion is studied for a number of classes of methods. Author (ESA)

N86-17065# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
THE NUMVEC FORTRAN LIBRARY MANUAL. CHAPTER: ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS (PDES). ROUTINE: MGZEB
W. M. Lioen Jul. 1985 21 p refs
(CWI-NM-R8518; B8569865) Avail: NTIS HC A02/MF A01

The NUMVEC FORTRAN Library routine MGZEB is described. The MGZEB solves 7-diagonal linear systems, that arise from 7-point discretizations of elliptic partial differential equations on a rectangle, using a multigrid technique with zebra relaxation as smoothing process. It is available in auto-vectorizable FORTRAN 77. Author (ESA)

N86-17066# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
CONDITIONAL AXIOMS AND ALPHA/BETA CALCULUS IN PROCESS ALGEBRA
J. C. M. Baeten, J. A. Bergstra, and J. W. Klop Feb. 1985 30 p refs Submitted for publication Sponsored by ESPRIT
(CWI-CS-R8502; B8567085) Avail: NTIS HC A03/MF A01

The alphabet of finite and infinite terms in algebra of communicating processes with silent steps, and approximations of it (the alpha/beta calculus) are given. The alphabet is used to formulate conditional axioms. The usefulness of these axioms is demonstrated. Author (ESA)

N86-17067# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
MEAN INTEGRATED SQUARED ERROR OF KERNEL ESTIMATORS WHEN THE DENSITY AND ITS DERIVATIVE ARE NOT NECESSARILY CONTINUOUS
C. vanEeden (Montreal Univ., Quebec) Nov. 1984 15 p refs Submitted for publication Sponsored by Formation de Chercheurs et d'Action Concertee Program, Quebec
(Grant A-3114)
(CWI-MS-R8414; B8569341) Avail: NTIS HC A02/MF A01

The asymptotic behavior of the mean integrated squared error (MISE), the optimal value of MISE, the asymptotically minimum value of MISE, and the optimal kernel of a density function f of a finite number of random variables identically distributed, when f and its derivative are not necessarily continuous, are studied. Rosenblatt-Epanechinkov's results are extended to the case where the density function is not continuous. Author (ESA)

N86-17068# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
THERE IS NO FINITE CLASSIFICATION FOR HOMOGENEOUS QUADRATIC VECTOR FIELDS ON R CUBED, MODULI OF STABILITY
S. J. vanStrien and G. TavaresdosSantos (Pontifica Univ. Catolica do Rio de Janeiro, Brazil) 1985 36 p refs
(Rept-85-02) Avail: NTIS HC A03/MF A01

It is shown that there are an uncountable number of homogeneous quadratic vector fields on R cubed so that no two of these vector fields are topologically equivalent. A family of homogeneous quadratic vector fields Xa on R cubed depending on a parameter a is a member of (a1,a2) such if Xa is topologically equivalent to Xa' at the origin in R cubed, then a=a prime, is shown to exist. This family has a nonstabilizable modulus of stability on the two-jet level. Author (ESA)

N86-17069# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
GLOBAL UNIVALENCE THEOREMS AND THE JACOBIAN MATRIX
T. Parthasarathy (Indian Statistical Inst., New Delhi, India), G. Ravindran (Indian Statistical Inst., New Delhi, India), and S. J. vanStrien 1985 23 p refs
(Rept-85-03) Avail: NTIS HC A02/MF A01

An example in Rsq to show that Gale-Nikaido's (1965) result on global univalence may not be valid in convex regions even if the Jacobian is a P-matrix is given. An example to demonstrate that global univalence may not prevail in R cubed even if the Jacobian is a nonsingular and nonnegative matrix throughout R cubed is given. This example is based on a smooth mapping of Rsq into itself given by Gale-Nikaido. A set of sufficient conditions under which a differentiable map is globally one-one over a closed convex region in R to the nth power is outlined. The global univalence results of Gale-Nikaido, Garcia-Zanwill (1979) and Mas-Colell (1979) when the Jacobian is a weak P-matrix are strengthened using McAuley's (1966) results. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-17070# California Univ., Berkeley. Lawrence Berkeley Lab.
CSEM-STEEL HYBRID WIGGLER/UNDULATOR MAGNETIC FIELD STUDIES
K. Halbach, E. Hoyer, S. Marks, D. Plate, and D. Shuman Jun. 1985 5 p refs
(Contract W-7405-eng-48)
(DE85-016081; UCRL-15689) Avail: NTIS HC A02/MF A01

Current design of permanent magnet wiggler/undulators use either pure charge sheet equivalent material (CSEM) or the CSEM-Steel hybrid configuration. Hybrid configurations offer higher field strength at small gaps, field distributions dominated by the pole surfaces and pole tuning. Nominal performance of the hybrid is generally predicted using a 2-D magnetic design code neglecting transverse geometry. Magnetic measurements are presented showing transverse configuration influence on performance, from a combination of models using CSEMs, REC (H sub c = 9.3 KOe) and NdFe (H sub c = 10.7 kOe), different pole widths and end configurations. Results show peak field improvement using NdFe in place of REC in identical models, gap peak field decrease with pole width decrease (all results less than computed 2-D fields), transverse gap field distributions, and importance of CSEM material overhanging the poles in the transverse direction for highest gap fields. DOE

N86-17071# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
MAGNETIC EXCHANGE INTERACTIONS IN THE LINEAR CHAIN CHROMIUM (3) COMPOUNDS CATENA-FLUORO PHTHALO-CYANINATO CHROMIUM (3) AND CATENA-CYANOPHTHALO CYANINATO CHROMIUM (3) Interim Technical Report
M. Schwartz, W. E. Hatfield, M. D. Joesten, M. Hanack, and A. Datz 15 Jul. 1985 27 p
(Contract N00014-76-C-0816)
(AD-A157861; TR-24) Avail: NTIS HC A03/MF A01 CSCL 20/3

Magnetic susceptibility and magnetization studies on the linear chain chromium(3) compounds catena-fluorophthalo cyaninato-chromium(III), CrPcF n, and catena-cyanophthalo cyaninatochromium (3), CrPcCNn, reveal that the chromium (3) ions in CrPcFn and CrPcCNn are magnetically exchange coupled. The magnetic susceptibility data for CrPcFn may be fit with Heisenberg linear chain theory for antiferromagnetic exchange with J = -12.2/cm and g = 2.00. The magnetic susceptiblity data for CrPcCNn may be fit with Heisenberg linear chain theory for ferromagnetic exchange with J = 0.2/cm and g = 1.98. CrPcCNn provides the first example of ferromagnetic exchange in a linear chain of chromium (3) ions. The difference in the exchange interactions in CrPcFn and CrPcCNn may be understood in terms of the electronegativities of the bridges and in terms of the orbitals which transmit the superexchange interactions. GRA

N86-17072# California Univ., Berkeley. Lawrence Berkeley Lab.
CSEM-STEEL HYBRID WIGGLER/UNDULATOR MAGNETIC FIELD STUDIES
K. Halbach, E. Hoyer, S. Marks, D. Plate, and D. Shuman May 1985 6 p Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-016635; LBL-19584; CONF-850504-245) Avail: NTIS HC A02/MF A01

Current design of permanent magnet wiggler/undulators use either pure charge sheet equivalent material (CSEM) or the CSEM-Steel hybrid configuration. Hybrid configurations offer higher field strength at small gaps, field distributions dominated by the pole surfaces and pole tuning. Nominal performance of the hybrid is generally predicted using a 2-D magnetic design code neglecting transverse geometry. Magnetic measurements are presented showing transverse configuration influence on performance, from a combination of models using CSEMs, REC (H sub c = 9.2 kOe) and NdFe (H sub c = 10.7 kOe), different pole widths and end configurations. Results show peak field improvement using NdFe in place of REC in identical models, gap peak field decreases with pole width decrease (all results less than computed 2-D fields), transverse gap field distributions, and importance of CSEM material overhanging the poles in the transverse direction for highest gap fields. DOE

N86-17073# Stanford Linear Accelerator Center, Calif.
MEASUREMENT PROBLEM IN PROGRAM UNIVERSE. REVISION
H. P. Noyes, C. Gefwert, and M. J. Manthey Jul. 1985 7 p refs Presented at the Symposium on the Foundations of Modern Physics, Joensuu, Finland, 16 Jun. 1985 Prepared in cooperation with Suomen Akatemia, Helsinki, Finland and New Mexico Univ., N. Mex.
(Contract DE-AC03-76SF-00515)
(DE85-017004; SU-SLAC-PUB-3537-Rev; CONF-850683-1-Rev) Avail: NTIS HC A02/MF A01

The measurement problem of contemporary physics is in our view an artifact of its philosophical and mathematical underpinnings. We describe a new philosophical view of theory formation, rooted in Wittgenstein, and Bishop's and Martin-Loef's constructivity, which obviates such discussions. We present an unfinished, but very encouraging, theory which is compatible with this philosophical framework. The theory is based on the concepts of counting and combinatorics in the framework provided by the combinatorial hierarchy, a unique hierarchy of bit strings which interact by an operation called discrimination. Measurement criteria incorporate c, h-bar and m/sub p/ or (not and) G. The resulting theory is discrete throughout, contains no infinities, and, as far as we have

developed it, is in agreement with quantum mechanical and cosmological fact. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N86-17074 New South Wales Univ., Kensington (Australia).
DETERMINATION OF ACOUSTICAL TRANSFER FUNCTIONS USING AN IMPULSE METHOD M.S. Thesis Abstract Only
John MacPherson Feb. 1985 2 p
Avail: Issuing Activity

The Transfer Function of a system may be defined as the relationship of the output response to the input of a system. Whilst recent advances in digital processing systems have enabled Impulse Transfer Functions to be determined by computation of the Fast Fourier Transform, there has been little work done in applying these techniques to room acoustics. Acoustical Transfer Functions have been determined for auditoria, using an impulse method. The technique is based on the computation of the Fast Fourier Transform (FFT) of a non-ideal impulsive source, both at the source and at the receiver point. The Impulse Transfer Function (ITF) is obtained by dividing the FFT at the receiver position by the FFT of the source. This quantity is presented both as linear frequency scale plots and also as synthesized one-third octave band data. The technique enables a considerable quantity of data to be obtained from a small number of impulsive signals recorded in the field, thereby minimizing the time and effort required on site. As the characteristics of the source are taken into account in the calculation, the choice of impulsive source is non-critical. The digital analysis equipment required for the analysis is readily available commercially. Author

N86-17075 Department of the Air Force, Washington, D.C.
TWO-DIMENSIONAL BULK ACOUSTIC WAVE CORRELATOR-CONVOLVER Patent
B. A. Auld, D. W. Pettibone, and J. D. Plummer, inventors (to Air Force) Issued 11 Jun. 1985 7 p Supersedes AD-D010275 (AD-D011908; US-Patent-4,523,293; US-Patent-Appl-SN-482377; US-Patent-Class-364-821) Avail: US Patent and Trademark Office CSCL 20/1

A two-dimensional bulk acoustic wave correlator-convolver having an acoustic mirror positioned two focal lengths from an integrated circuit-acoustic transducer array is discussed. The image, rather than the Fourier transform, of the input spatial distribution is returned to the transducer array by the mirror. Author (GRA)

N86-17076# Committee on Science and Technology (U. S. House).
NOISE REDUCTION TECHNOLOGY
Washington GPO 1985 135 p Hearing before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology, 99th Congr., 1st Sess., no. 16, 1 Apr. 1985
(GPO-48-026) Avail: Subcommittee on Transportation, Aviation and Materials

A congressional hearing was conducted and expert testimony heard concerning noise reduction technology as it applied to airports. G.L.C.

N86-17077*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARISON OF ADVANCED TURBOPROP AND CONVENTIONAL JET AND PROPELLER AIRCRAFT FLYOVER NOISE ANNOYANCE: PRELIMINARY RESULTS
David A. McCurdy Nov. 1985 30 p refs Presented at the 110th Acoustical Society American Conference, Nashville, Tenn., 4-8 Nov. 1985
(NASA-TM-87637; NAS 1.15:87637) Avail: NTIS HC A03/MF A01 CSCL 20A

A laboratory experiment was conducted to compare the flyover noise annoyance of proposed advanced turboprop aircraft with that of conventional turboprop and jet aircraft. The effects of fundamental frequency and tone-to-broadband noise ratio on advanced turboprop annoyance were also examined. A computer synthesis system is used to generate 18 realistic, time varying simulations of propeller aircraft takeoff noise in which the harmonic content is systematically varied to represent the factorial combinations of six fundamental frequencies ranging from 67.5 Hz to 292.5 Hz and three tone-to-broadband noise ratios of 0, 15, and 30 dB. These advanced turboprop simulations along with recordings of five conventional turboprop takeoffs and five conventional jet takeoffs are presented at D-weighted sound pressure levels of 70, 80, and 90 dB to 32 subjects in an anechoic chamber. Analyses of the subjects' annoyance judgments compare the three categories of aircraft and examine the effects of the differences in harmonic content among the advanced turboprop noises. The annoyance prediction ability of various noise measurement procedures and corrections is also examined. Author

N86-17078# Polar Research Lab., Inc., Carpinteria, Calif.
LONG TERM STATISTICAL MEASUREMENTS OF ENVIRONMENTAL ACOUSTICS PARAMETERS IN THE ARCTIC: AMBIENT NOISE LEVELS IN THE WEST GREENLAND SEA
B. M. Buck and D. W. Jaecks 13 Dec. 1984 644 p
(Contract N00014-84-C-0394)
(AD-A156818; PRL-TR-53; ARAS-1) Avail: NTIS HC A99/MF A01 CSCL 20/1

Propagation loss data were taken using manned ice camps and aircraft, and ambient noise levels were measured using arctic data buoys that operated through the NIMBUS 6 and NOAA series satellites. The present report addresses one of a total of six arctic geographic areas - the West Greenland Sea, and presents ambient noise levels taken evvery three hours at the synoptic weather times from nine data buoys that drifted through the area. These data buoys collect a very large amount of independent measurements that are impractical to present in raw form. Therefore, a first-level statistical analysis was performed to allow reporting and distribution. These data, along with other regularly available meteorological, oceanographic and ice data, should enable higher order analyses and modeling for both prediction and understanding the mechanisms of arctic background noise. The data buoys, while limited in some respects, offer the only present means of long-term, wide-area investigations of arctic ambient noise on a true statistical basis. GRA

N86-17079# Naval Postgraduate School, Monterey, Calif.
A MATCHED FILTER ALGORITHM FOR ACOUSTIC SIGNAL DETECTION M.S. Thesis
D. W. Jordan Jun. 1985 222 p
(AD-A158960) Avail: NTIS HC A10/MF A01 CSCL 17/1

This thesis is a presentation of several alternative acoustic filter designs which allow Space Shuttle payload experiment initiation prior to launch. This initiation is accomplished independently of any spacecraft services by means of a matched band-pass filter tuned to the acoustic signal characteristic of the Auxiliary Power Unit (APU) which is brought up to operating RPM's approximately five minutes prior to launch. These alternative designs include an analog filter built around operational amplifiers, a digital IIR design implemented with an INTEL 2920 Signal Processor, and an Adaptive FIR Weiner design. Working prototypes of the first two filters are developed and a discussion of the advantage of the 2920 digital design is presented. GRA

N86-17080# Oak Ridge Y-12 Plant, Tenn.
ULTRASONIC ANALYSIS OF KEVLAR-EPOXY FILAMENT WOUND STRUCTURES
W. D. Brosey 16 Jul. 1985 32 p Presented at the Society of Manufacturing Engineers: Filament Winding Technology, Anaheim, Calif., 10 Sep. 1985
(Contract DE-AC05-84OS-21400)
(DE85-017405; Y/DW-611; CONF-8509145-1) Avail: NTIS HC A03/MF A01

Composite structures are often desirable for their strength and

weight characteristics. Since composites are not as well characterized mechanically as metallic or ceramic structures, much work has been performed at the Oak Ridge Y-12 Plant to obtain that characterization and to develop methods of determining the mechanical properties of a composite nondestructively. Most of the work to date has been performed on nonenclosed structures. One notable exception has been the holographic evaluation of spherical Kevlar-epoxy composite pressure vessels. Several promising nondestructive evaluation techniques have been used to locate flaws and predict the integrity of the composite. Several of these include thermography, Moire interferometry, ultrasonic stress wave factor, ultrasonic C-scan image enhancement, radiography, and nuclear magnetic resonance. As a first step in this transfer and development of NDE techniques, known defects were placed within spherical Kevlar-epoxy, filament-wound test specimens to determine the extent to which they could be detected. These defects included Teflon shim-simulated delaminations, macrosphere-simulated voids, dry-band sets, variable tension, Kevlar 29 fiber instead of the higher strength Kevlar 40 fiber, and an alternate high-void-content winding pattern. Ultrasonic waveform analysis was performed in both the time and frequency domains to determine the detectability and locatability of structural flaws within the composite. Preparation has been made at Virginia Polytechnic Institute and State University and at the University of Delaware, to examine the specimens using various NDE techniques. This work is a compilation of interim project reports in partial fulfillment of the contracts between Virginia Polytechnic Institute and State University, the University of Delaware, and Y-12 Plant.
DOE

N86-17081# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
AEROACOUSTIC RESEARCH IN THE NETHERLANDS RELATED TO AIRCRAFT DEVELOPMENT
W. B. deWolf and S. L. Sarin 25 May 1985 11 p refs Presented at 14th ICAS Congr., Toulouse, France, 9-14 Sept. 1984 Sponsored by Netherlands Agency for Aerospace Programs
(NLR-MP-84049-U; B8568094; ICAS-84-5.8.2) Avail: NTIS HC A02/MF A01

For jet noise reduction the feasibility of a lined ejector nozzle for the Fokker F28 aircraft was investigated by scale model measurements using decomposed hydrogen peroxide for hot jet simulation. Thrust performance measurements were included. For the design of optimum acoustic liners a mathematical model was developed to represent the fan and engine duct acoustically, taking into account the sound generation by rotor wake/stator interaction. Acoustic measurements were performed in the engine inlet of a Fokker F28 aircraft during flight. Techniques and facilities were developed for accurate in-situ measurements of the impedance of acoustic liner materials under realistic conditions. The technique was also demonstrated in-flight. Large reductions of the propeller noise level inside the cabin of the Fokker F27 aircraft were obtained by dynamic vibration absorbers on the fuselage wall structure.
Author (ESA)

N86-17082# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
THE USE OF ULTRASONIC SH WAVES TO MEASURE RESIDUAL STRESSES IN TEXTURED MATERIALS
D. R. Allen and R. Langman Jan. 1985 36 p
(AERE-R-11573) Avail: NTIS HC A03/MF A01

Measurements of the angular dependence of the zero order SH wave velocity have been made in several rolled thin plate samples (approx. 1 mm) of aluminum, stainless steel, copper and brass. In each case the velocities for waves propagating along the rolling direction and transverse direction are the same to within experimental error despite the generally high levels of texture present in the samples studied. This supports the use of such an approach as a valid basis for a residual stress measurement technique. A texture model is proposed which predicts the variation of ultrasonic velocity with texture for a given material. The experimental results are found to be in agreement with the proposed model.
Author

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-17083 New South Wales Univ., Kensington (Australia).
STUCTURAL STUDIES OF SPIN CROSSOVER SYSTEMS Ph.D. Thesis Abstract Only
Anthony Thomas Baker 1984 3 p
Avail: Issuing Activity

A major intention was to structurally characterize iron (II) complexes which undergo thermally-induced spin-state transitions. In the course of the work, several compounds which display spin-transition properties were prepared. The ligands of these new complexes all incorporate a thiazolyl moiety and comparisons of the coordinating capacity of this heterocycle with other heterocyclic systems have been made.
Author

N86-17084# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE 2-D HYDROGEN MOLECULE USING AMO APPROXIMATION
E. A. deAndradaeSilva, I. C. daCunhaLima, and A. FerreiradaSilva Sep. 1985 15 p refs Submitted for publication
(INPE-3661-PRE/821) Avail: NTIS HC A02/MF A01

The eigenenergies of the hydrogen molecule are calculated in the Alternate Molecular Orbital (AMO) approximation. Emphasis is given to two-dimensional (2-D) systems. Results are compared for the 2-D and 3-D cases and also with the singlet state of the Variational Heitler-London (H-L) approximation. Unlike what is observed in 3-D, in 2-D it is found that in the ground state electrons are highly correlated and the double occupancy is inhibited.
Author

N86-17085# Connecticut Univ., Storrs.
IN SITU STUDIES OF ENERGY DEPOSITION BY ION BEAMS Final Technical Report, 1 Sep. 1980 - 31 Aug. 1983
J. I. Budnick, F. P. Lipschultz, F. Namavar, F. A. Otter, and T. W. Grudkowski 14 Jun. 1985 71 p Prepared in cooperation with United Technologies Corp., East Hartford, Conn.
(Contract N00014-80-C-0910)
(AD-A156932) Avail: NTIS HC A04/MF A01 CSCL 20/12

The results of initial surface acoustic wave studies on a variety of systems including lithium niobate (LiNbO3), quartz (SiO2), silicon on LiNbO3 silicon on SiO2 and silicon on sapphire, which have been subjected to ion implantation and to visible laser irradiation. In addition, results of ion beam mixing studies on the Aluminum-Silicon system are reported, as well as the application of nuclear resonance profiling to a study of the near surface aluminum distribution in silicon.
Author (GRA)

N86-17086# Chicago Univ., Ill.
POSSIBLE MECHANISMS OF ATOM TRANSFER IN SCANNING TUNNELING MICROSCOPY
R. Gomer Jul. 1985 9 p
(Contract N00014-77-C-0018)
(AD-A158660) Avail: NTIS HC A02/MF A01 CSCL 20/10

Various mechanisms for the sudden transfer of an atom from or to the tip of a scanning tunneling microscope are considered. It is concluded that thermal desorption could be responsible and also that quasi-contact in which the adsorbed atom is in effect touching both surfaces, which would still be separated from each other by 2-4 A can also lead to unactivated transfer via tunneling. For barrier widths as small as 0.5 A, however, tunneling becomes negligible.
GRA

N86-17087# Naval Research Lab., Washington, D. C.
THE LINDHARD, NIELSEN AND SCHARFF METHOD OF OBTAINING APPROXIMATE CROSS SECTIONS
G. P. Mueller 10 Sep. 1985 18 p
(AD-A159355; AD-E700020; NRL-MR-5624) Avail: NTIS HC A02/MF A01 CSCL 12/1

Scattering theory gives an exact expression for generating a differential cross section from a known inter-particle potential.

Conversely, if one has a cross section, there is an exact inversion process that yields the potential that is its counterpart. Lindhard, Nielsen and Scharff (LNS) developed an approximate method to generate cross sections. Their Thomas-Fermi cross section is widely used in atomic scattering and radiation damage calculations. In this report the author describes the three approximations that make up the LNS method and the corresponding (approximate) inversion process. Several examples are furnished, including ones that demonstrate the utility of starting with a cross section and using the simplified inversion process to generate the corresponding approximate potential. Author (GRA)

N86-17088# Naval Research Lab., Washington, D. C.
PHAZR: A PHENOMENOLOGICAL CODE FOR HOLEBORING IN AIR
J. M. Picone, J. P. Boris, M. Lampe, and K. Kailasanath 25 Sep. 1985 56 p
(ARPA Order 4395)
(AD-A159401; NRL-MR-5647) Avail: NTIS HC A04/MF A01 CSCL 20/8

This report describes a new code for studying holeboring by a charged particle beam, laser, or electric discharge in a gas. The coordinates which parameterize the channel are radial displacement (r) from the channel axis and distance (z) along the channel axis from the energy source. The code is primarily phenomenological that is, we use closed solutions of simple models in order to represent many of the effects which are important in holeboring. The numerical simplicity which we gain from the use of these solutions enables us to estimate the structure of channel over long propagation distances while using a minimum of computer time. This feature makes PHAZR a useful code for those studying and designing future systems. Of particular interest is the design and implementation of the subgrid turbulence model required to compute the enhanced channel cooling caused by asymmetry-driven turbulence. The approximate equations of Boris and Picone form the basis of the model which includes the effects of turbulent diffusion and fluid transport on the turbulent field itself as well as on the channel parameters. The primary emphasis here is on charged particle beams, and as an example, we present typical results for an ETA-like beam propagating in air. These calculations demonstrate how PHAZAR may be used to investigate accelerator parameter space and to isolate the important physical parameters which determine the holeboring properties of a given system. The comparison with two-dimensional calculations provide a calibration of the subgrid turbulence model. Author (GRA)

N86-17089# Brookhaven National Lab., Upton, N. Y.
REVERSIBLE ISING DYNAMICS
M. Creutz 1985 8 p Presented at the Conference on Advances in Lattice Gauge Theory, Coral Gables, Fla., 10 Apr. 1985
(Contract DE-AC02-76CH-00016)
(DE85-016059; BNL-36727; CONF-8504167-1) Avail: NTIS HC A02/MF A01

The author discusses a reversible deterministic dynamics for Ising spins. The algorithm is a variation of microcanonical Monte Carlo techniques and is easily implemented with simple bit manipulation. This provides fast programs to study non-equilibrium phenomena such as heat flow. DOE

N86-17090# California Univ., Berkeley. Lawrence Berkeley Lab.
LBL NEUTRALIZED BEAM FOCUSING EXPERIMENT
G. A. Krafft, C. H. Kim, and L. Smith May 1985 6 p Presented at the Particle Accelerator Conference, Vancouver, Canada, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-016564; LBL-19529; CONF-850504-240) Avail: NTIS HC A02/MF A01

An intense neutralized Cs(+1) beam has been focused by an electrostatic polarization field induced by a solenoidal magnetic field of 10-25 gauss. This report describes the experiment and compares the results with the predictions of an analytic linearized fluid model and a particle-in-cell simulation which treats the motion of the warm electrons in detail. DOE

N86-17091# Stanford Linear Accelerator Center, Calif.
WORKSHOP ON e(+)e(-) PHYSICS AT HIGH LUMINOSITIES: PROCEEDINGS
May 1985 391 p Workshop held at Stanford, Calif., 30 Nov. 1984
(Contract DE-AC03-76SF-00515)
(DE85-016524; SU-SLAC-283; CONF-8411186-; CONF-8504155) Avail: NTIS HC A03/MF A01

Ten papers were read at the Workshop on the Physics of High Luminosity Electrons held at Stanford, California, on 30 November, 1984. The ten papers are abstracted and listed separately. DOE

N86-17092# Lawrence Livermore National Lab., Calif.
ATOM-IN-JELLIUM MODELS
D. A. Liberman 26 Apr. 1985 21 p Presented at the Limeil Laboratory of the French Atomic Energy Commission Meeting, Paris, France, 6 May 1985
(Contract W-7405-eng-48)
(DE85-016075; UCRL-92565; CONF-8505196-1) Avail: NTIS HC A02/MF A01

The author describes in this paper the atom-in-jellium calculations he has been doing over the last ten years. He tries to emphasize reasons for doing this sort of calculation and why he devised a model which is different in some respects from others. DOE

N86-17093# Florida State Univ., Tallahassee.
ENERGY TRANSFORMATION IN MOLECULAR ELECTRONIC SYSTEMS
M. Kasha 25 Jul. 1985 11 p refs
(Contract DE-AS05-78EV-05855)
(DE85-017187; DOE/EV-05855/8) Avail: NTIS HC A02/MF A01

Our new optical pumping spectroscopy allows the production and study of the unstable rate tautomer in its ground and excited states, including picosecond dynamic studies. Molecules under study here included 7-azaindole 3-hydroxyflavone, lumichrome, and other heterocyclics. New detailed molecular mechanisms for proton transfer are derived, especially with catalytic assisting molecules. A new proton-transfer laser of extraordinary efficiency has become a side dividend, possibly worthy of industrial development. The excited and highly reactive singlet molecular oxygen species (1) DELTA sub g has proven to be ubiquitous in chemical peroxide systems and in physically excited sensitizer-oxygen systems. Hyperbaric oxygen mechanisms in biology probably involve singlet oxygen. We have undertaken a spectroscopic study of trisdibenzoylmethane chelates of Al, Gd, Eu, and Yb trivalent ions. These chelates offer a variety of electronic behaviors, from Z-effects on (PI)--electron spin-orbital coupling (Al, Gd) to Weissman intramolecular energy transfer to 4f mestable levels (Eu, Gd). Elegant new spectroscopic resolution at 77K permits separation of tautomeric, parasitic self-absorption, dissociation, and cage effects to be resolved. DOE

N86-17094# Los Alamos National Lab., N. Mex.
LOW EMITTANCE GROWTH FUNNELING LINE: PRELIMINARY DESIGN AND BEAM DYNAMICS STUDY
F. W. Guy 1985 10 p Presented at the Workshop on High Brightness, High Current, High Duty Factor Ion Injectors, San Diego, Calif., 21 May 1985
(Contract W-7404-eng-36)
(DE85-015687; LA-UR-85-2189; CONF-8505164-5) Avail: NTIS HC A02/MF A01

A theoretical design study has resulted in a conceptual funneling-line design that has a transverse emittance growth limited to only 15% based on beam-dynamics calculations. Two 2-MeV, 100-mA proton beams are funneled from a two-channel, 212.5-MHz radio-frequency quadrupole (RFQ) to a single beam suitable for injection into a 425-MHz linac. The design uses permanent-magnet quadrupoles, dipoles, and combined-function elements. The low emittance growth is obtained by arranging the focusing strength, the periodic structure, and the bending elements so as to minimize

abrupt changes in the beam environmental with consequent charge redistribution and space-charge-caused emittance growth. DOE

N86-17095# Oak Ridge National Lab., Tenn.
EFFECTS OF TEMPERATURE ON DISSOCIATIVE AND NONDISSOCIATIVE ELECTRON ATTACHMENT
L. G. Christophorou, S. R. Hunter, J. G. Carter, and S. M. Spyrou 1985 26 p refs Presented at the Joint Symposium on Swarm Studies and Inelastic Electron-Molecule Collisions, Tahoe, Calif., 19 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016473; CONF-850776-1) Avail: NTIS HC A03/MF A01

Results of recent studies on the effects of temperature, T, on the dissociative and nondissociative electron attachment to molecules are presented and discussed. DOE

N86-17096# Brookhaven National Lab., Upton, N. Y.
STUDY FOR A 6 GeV UNDULATOR BASED SYNCHROTRON RADIATION SOURCE
G. Vignola, M. Barton, R. Blumberg, J. Galayda, S. Krinsky, A. Luccio, C. Pellegrini, A. VanSteenbergen, and J. Wang 1985 3 p Presented at the Particle Accelerator Conference, Vancouver, Canada, 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-012183; BNL-36444; CONF-850504-173) Avail: NTIS HC A02/MF A01

A partial study of a 6 GeV undulator based synchrotron radiation source for production of high brightness undulator radiation, in the A region, is presented. The basic lattice adopted for the storage ring is a hybrid FODO Chasman-Green lattice, making use of gradient in the dipoles. We discuss also the beam current limits and the injection parameters. DOE

N86-17097# Lawrence Livermore National Lab., Calif.
WHAT IS WRONG WITH THE CROMER-LIBERMAN ANOMALOUS SCATTERING FACTORS AND WHAT TO DO ABOUT THEM
D. A. Liberman 18 Mar. 1985 9 p Presented at New Direction in X-Ray Scattering Workshop, Asilomar, Calif., 3 Apr. 1985
(Contract W-7405-eng-48)
(DE85-012947; UCRL-92338; CONF-8504136-2) Avail: NTIS HC A02/MF A01

Some sources of error in the original Cromer-Liberman equation for anomalous X-ray scattering are discussed and possible corrections are suggested. G.L.C.

N86-17098# Argonne National Lab., Ill.
UNIFIED APPROACH TO PION ABSORPTION AND DOUBLE-CHARGE-EXCHANGE REACTIONS
T. S. H. Lee 1985 9 p refs Presented at the Workshop on DCX Reactions, Los Alamos, N. Mex., 10 Jan. 1985
(Contract W-31-109-eng-38)
(DE85-012107; CONF-850176-1) Avail: NTIS HC A02/MF A01

Pion absorption and DCX Reactions are studied by using a unified theory of NN and PI d scattering. It is shown that the theory can describe simultaneously the (PI +, pp), (PI -, pn) and (PI -, PI +) reactions of 3 He. The study of absorption on heavy nuclei indicates the importance of inelastic absorption processes. It is suggested that the DCX reaction on heavy nuclei also involves multi-step processes which cannot be solved within the conventional distorted-wave theory. DOE

N86-17099# Los Alamos National Lab., N. Mex.
RELATIVISTIC HYDRODYNAMICS, HEAVY ION REACTIONS AND ANTIPROTON ANNIHILATION
D. Strottman 1985 28 p Presented at the Cretan International Meeting on Subatomic Physics, Crete, Greece, 23 Jun. 1985
(Contract W-7405-eng-36)
(DE85-014069; LA-UR-85-2281; CONF-8506178-2) Avail: NTIS HC A03/MF A01

The application of relativistic hydrodynamics to relativistic heavy ions and antiproton annihilation is summarized. Conditions for validity of hydrodynamics are presented. Theoretical results for inclusive particle spectra, pion production and flow analysis are given for medium energy heavy ions. The two-fluid model is introduced and results presented for reactions from 800 MeV per nucleon to 15 GeV on 15 GeV per nucleon. Temperatures and densities attained in antiproton annihilation are given. Finally, signals which might indicate the presence of a quark-gluon plasma are briefly surveyed. DOE

N86-17100# Oak Ridge National Lab., Tenn.
ROLE OF INDIRECT PROCESSES IN ELECTRON-IMPACT IONIZATION OF MULTICHARGED IONS
D. C. Gregory 1985 11 p Presented at the 14th International Conference on the Physics of Electronic and Atomic Collisions, Palo Alto, Calif., 24 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016960; CONF-850701-1) Avail: NTIS HC A02/MF A01

Recent studies of electron impact ionization in this laboratory are discussed with emphasis on the role of indirect processes. Examples are used to illustrate the importance of excitation-autoionization (Ti sup 2+ and Al sup 2+), autoionizing metastable ions in the Na isoelectronic sequence, multiple ionization (triple ionization of Xe sup 6+), the relative importance of indirect ionization with increasing charge in the Mg isoelectronic sequence, and the extension of ionization measurements to higher-charged target ions (Fe sup 9+). DOE

N86-17101# Stanford Linear Accelerator Center, Calif.
LIMITING TECHNOLOGIES FOR PARTICLE BEAMS AND HIGH ENERGY PHYSICS
W. K. H. Panofsky Jul. 1985 8 p Presented at the SLAC Summer School on the Physics of High Energy Particle Accelerators, Stanford, Calif., 15 Jul. 1985
(Contract DE-AC03-76SF-00515)
(DE85-017003; SU-SLAC-PUB-3735; CONF-850771-2) Avail: NTIS HC A02/MF A01

Since 1930 the energy of accelerators had grown by an order of magnitude roughly every 7 years. Like all exponential growths, be they human population, the size of computers, or anything else, this eventually will have to come to an end. When will this happen to the growth of the energy of particle accelerators and colliders? Fortunately, as the energy of accelerators has grown the cost per unit energy has decreased almost as fast as has the increase in energy. The result is that while the energy has increased so dramatically the cost per new installation has increased only by roughly an order of magnitude since the 1930's (corrected for inflation), while the number of accelerators operating at the frontier of the field has shrunk. As is shown in the by now familiar Livingston chart this dramatic decrease in cost has been achieved largely by a succession of new technologies, in addition to the more moderate gains in efficiency due to improved design, economies of scale, etc. We are therefore facing two questions: (1) Is there good reason scientifically to maintain the exponential growth, and (2) Are there new technologies in sight which promise continued decreases in unit costs. The answer to the first question is definitely yes; the answer to the second question is maybe. DOE

N86-17102# Fermi National Accelerator Lab., Batavia, Ill.
DETERMINATION OF THE NUCLEON STRUCTURE USING THE WEAK NEUTRAL CURRENT
D. Bogert, R. Burnstein, R. Fisk, S. Fuess, J. G. Morfin, T. Ohska, L. Stutte, J. K. Walker, J. Bofill, and W. Busza Jul. 1985 10 p refs Presented at the 12th International Symposium on Lepton and Photon Interactions At High Energies, Kyoto, Japan, 19 Aug. 1985 Prepared in cooperation with Massachusetts Inst. of Tech., Cambridge and Michigan State Univ., East Lansing
(Contract DE-AC02-76CH-03000)
(DE85-017360; FNAL/C-85/108-E; CONF-850819-4) Avail: NTIS HC A02/MF A01

An experimental determination of the neutral current structure functions of the nucleon is obtained by measuring the ratio of the neutral current x distribution to the charged current x distribution. The analysis is based on deep inelastic neutrino nucleon scattering

data gathered in a massive fine-grained neutrino detector exposed to a narrow band neutrino beam at Fermilab. DOE

N86-17103# Fermi National Accelerator Lab., Batavia, Ill.
DETERMINATION OF sin(2)theta/SUB w/ AND rho IN DEEP INELASTIC NEUTRINO-NUCLEON SCATTERING
D. Bogert, R. Burnstein, R. Fisk, S. Fuess, J. Morfin, T. Ohska, L. Stutte, J. K. Walker, J. Bofill, and W. Busza Jun. 1985 10 p refs Presented at the 12th International Symposium on Lepton and Photon Interactions At High Energies, Kyoto, Japan, 19 Aug. 1985 Prepared in cooperation with Massachusetts Inst. of Tech., Cambridge and Michigan State Univ., East Lansing
(Contract DE-AC02-76CH-03000)
(DE85-017361; FNAL/C-85/107-E; CONF-850819-3) Avail: NTIS HC A02/MF A01

We have determined the electroweak parameters sin(2)theta/sub w/ and rho by a measurement of deep inelastic neutrino-nucleon scattering using a fine grained neutrino detector exposed to a narrow band neutrino beam at Fermilab. The unique sampling properties of our detector have permitted neutral current and charged current events to be unambiguously identified over a wide kinematic range, thereby allowing a determination of sin(2) theta/sub w/ and rho to be made with good statistics and small systematic errors. We have found sin(2)theta/sub w/ equals 0.246 plus or minus 0.012 plus or minus 0.013 in a single parameter fit. The details of the experimental and theoretical systematic errors are given. DOE

N86-17104# Oregon Univ., Eugene. Inst. of Theoretical Science.
THEORY OF ELEMENTARY PARTICLES Final Report
1985 51 p
(Contract DE-AT06-76ER-70004)
(DE85-017610; DOE/ER-70004/327) Avail: NTIS HC A04/MF A01

Progress is reported in these areas: soft X-ray Li laser pumped by synchrotron radiation; microbunching electron beams; laser acceleration of particles; generation of short risetime radiation pulses from electron storage rings; optimally effective X-ray gratings and zone plates; CP noninvariance, grand unification, and supersymmetry; hadron-nucleus collisions; quark-gluon plasma; polarization phenomena; the Drell-Yan process; supersymmetry phenomenology; Higgs particles; structure of cross-sections for sequential production and decay of spinning particles; flavor changing neutral currents. DOE

N86-17105# California Univ., Berkeley. Lawrence Berkeley Lab.
FINDING A RATIONAL NOMENCLATURE FOR MESONS AND BARYONS
R. M. Barnett, R. N. Cahn, G. Gidal, A. Rittenberg, T. G. Trippe, C. G. Wohl, G. P. Yost, F. C. Porter, J. J. Hernandez, and L. Montanet May 1985 9 p Presented at the International Conference on Hadron Spectroscopy, College Park, Md., 20 Apr. 1985 Prepared in cooperation with California Inst. of Tech., Pasadena, European Organization for Nuclear Research, Geneva, Switzerland, Helsinki Univ., Finland and Stanford Linear Accelerator Center, Menlo Park, Calif.
(Contract DE-AC03-76SF-00098)
(DE85-017646; LBL-19612; CONF-8504133-10) Avail: NTIS HC A02/MF A01

A history of the Particle Data Group's efforts to find a rational and systematic convention for naming mesons and baryons is given. Several versions of our proposal are reviewed, and name changes which would occur are summarized. DOE

N86-17106# Department of Energy, Washington, D. C.
IMPROVED LIQUID-FILM ELECTRON STRIPPER Patent Application
B. F. Gavin, inventor (to DOE) (California Univ., Berkeley. Lawrence Berkeley Lab.) Filed 1 Nov. 1984 20 p
(Contract DE-AC03-76SF-00098)
(DE85-017765; US-Patent-Appl-SN-667255) Avail: NTIS HC A02/MF A01

An improved liquid-film electron stripper particularly for high intensity heavy ion beams which produces constant regenerated, stable, free-standing liquid films having an adjustable thickness between 0.3 to 0.05 microns is discussed. The improved electron stripper is basically composed of at least one high speed, rotating disc with a very sharp, precision-like, ground edge on one side of the disc's periphery and with highly polished, flat, radial surface adjacent the sharp edge. A fine stream of liquid, such as oil, impinges at a 90(0) angle adjacent the disc's sharp outer edge. Film terminators, located at a selected distance from the disc perimeter are positioned approximately perpendicular to the film. The terminators support, shape, and stretch the film and are arranged to assist in the prevention of liquid droplet formation by directing the collected film to a reservoir below without breaking or interfering with the film. One embodiment utilizes two rotating discs and associated terminators, with the discs rotating so as to form films in opposite directions, and with the second disc being located down beam-line relative to the first disc. DOE

N86-17107# Argonne National Lab., Ill.
OPTICAL SPECTRA AND ELECTRONIC STRUCTURE OF ACTINIDE IONS IN COMPOUNDS AND IN SOLUTION
W. T. Carnall and H. M. Crosswhite Aug. 1985 154 p refs
(Contract W-31-109-eng-38)
(DE85-018310; ANL-84-90) Avail: NTIS HC A08/MF A01

This report provides a summary of theoretical and experimental studies of actinide spectra in condensed phases. Much of the work was accomplished at Argonne National Laboratory, but references to related investigations by others are included. Spectroscopic studies of the trivalent actinides are emphasized, as is the use of energy level parameters, evaluated from experimental data, to investigate systematic trends in electronic structure and other properties. Some reference is made to correlations with atomic spectra, as well as with spectra of the (II), (IV), and higher valence states. DOE

N86-17108# Argonne National Lab., Ill.
INTERPRETATIONS OF THE NUCLEAR DEPENDENCE OF DEEP-INELASTIC LEPTON SCATTERING
E. L. Berger Jun. 1985 60 p refs Presented at the Topical Seminar on Few and Many Quark Systems, San Miniato, Italy, 25 Mar. 1985
(Contract W-31-109-eng-38)
(DE85-018413; CONF-8503146-2) Avail: NTIS HC A04/MF A01

A review is presented of data and theoretical interpretations of A dependent effects observed in the deep inelastic scattering of neutrinos and charged leptons from nuclei. After a detailed summary of the experimental situation and survey of the broad spectrum of proposed explanations, I concentrate on the implications of a pion exchange model. This conventional nuclear physics approach provides a unified quantitative description of all features of the present data except, possibly, for the normalization at small x. The pion exchange model reproduces the magnitude and shape of the depression below unity of the ratio of structure functions F2/sup A/(x,Q(2))/F2/sup D/(x,Q(2)) for $0.2 < x < 0.6$, observed in all experiments, its rise above unity as x (YIELDS) 1, and the weak enhancement of the antiquark distribution anti q/sup A/(x) demonstrated by the neutrino experiments. If the normalization of the European Muon Collaboration data is reduced by 5%, the model would be in fine agreement for all x. Expectations are presented for the A dependence of massive lepton pair production in hadron collisions. The review concludes with a list of desirable future experiments. DOE

N86-17109# Los Alamos National Lab., N. Mex.
EXPERIMENTS ON ETA-MESON PRODUCTION
J. C. Peng 1985 17 p refs Presented at the Hadronic Probes and Nuclear Interactions Conference, Tempe, Ariz., 11 Mar. 1985
(Contract W-7405-eng-36)
(DE85-010724; LA-UR-85-1511; CONF-8503120-7) Avail: NTIS HC A02/MF A01

Following a review of some highlights of eta-meson characteristics, the status of eta-meson production experiments is reviewed.

The physics motivations and first results of two LAMPF experiments on ((Pl),eta) reactions are discussed. Possible future experiments are also discussed. DOE

N86-17110# Colorado State Univ., Fort Collins. Dept. of Physics.
HIGH-ENERGY NEUTRON SPECTROSCOPY ON F-ELECTRON OXIDES
S. Kern, C. K. Loong, and G. H. Lander 1985 10 p refs Presented at the International Conference on Neutron Scattering, Santa Fe, N. Mex., 19 Aug. 1985 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE85-017387; CONF-850871-8) Avail: NTIS HC A02/MF A01

Neutron inelastic scattering with the chopper spectrometers at IPNS has been used to measure, for the first time, the ground to excited crystal field transitions in PrO2 (130 meV), BaPrO3 (255 meV), and UO2 (approx.160 meV). From these measurements we deduce the values of V4 = A4 < r(4) > and compare both the absolute values and their variation with theoretical estimates. In the case of UO2 two peaks are seen, one at 155 and the other at 172 meV. This structure exists both below and above T sub N (30.8K) and we believe is caused by a dynamic Jahn-Teller effect that splits the excited GAMMA3 state. DOE

N86-17111# Brookhaven National Lab., Upton, N. Y.
HIGH ENERGY NUCLEAR COLLISIONS: PHYSICS PERSPECTIVES
H. Satz 1985 21 p refs Presented at the Workshop on Experiments for RHIC, Upton, N.Y., 15 Apr. 1985 Prepared in cooperation with Bielefeld Univ. (West Germany)
(Contract DE-AC02-76CH-00016)
(DE85-017511; BNL-36817; CONF-8504152-7) Avail: NTIS HC A02/MF A01

The main aim of relativistic heavy ion experiments is to study the states of matter in strong interaction physics. We survey the predictions which statistical QCD makes for deconfinement and the transition to the quark-gluon plasma. DOE

N86-17112# California Univ., Berkeley. Lawrence Berkeley Lab.
HIGH-SPIN PROPERTIES OF SOME NUCLEI AROUND A = 160
F. S. Stephens May 1985 18 p Presented at the Symposium on Nuclear Structure, Copenhagen, Denmark, 20 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-017653; LBL-19980; CONF-8505166-4) Avail: NTIS HC A02/MF A01

Two new types of behavior have been observed in (Er-156). The first is a terminating band ending on a 42+ fully aligned state. The second is a strong cross feeding among four negative parity bands, due most likely to a severe reduction or collapse of the neutron pairing. In (Er-156) we have found two sequences feeding the 38+ level; one slow and one fast. This suggests that some feeding goes through regions of oblate (or nearly so) shapes, and some does not. Lifetimes have been determined for levels around 30+ in (Yb-166), which seem to be longer than is easily explained. DOE

N86-17113# State Univ. of New York, Stony Brook.
ELASTIC SCATTERING OF NEUTRINOS BY ELECTRONS AND PROTONS
D. Hedin 1985 13 p refs Presented at the International Europhysics Conference on High Energy Physics, Bari, Italy, 18 Jul. 1985
(Contract DE-AC02-76CH-00016)
(DE86-000024; BNL-36912; CONF-850721-4) Avail: NTIS HC A02/MF A01

Measurements of the cross sections for neutrino and antineutrino elastic scattering by both electrons and protons are presented. These measurements were done at the Brookhaven AGS by the E734 Collaboration (Brookhaven/Brown/KEK/Osaka/Pennsylvania/Stony Brook). These results are then used to determine the weak mixing angle sin squared theta sub w. DOE

N86-17114# Washington Univ., Seattle. Nuclear Physics Lab.
COLLIDING-BEAMS POLARIZED ION SOURCE
T. A. Trainor, J. G. Douglas, D. Badt, C. Christiensen, A. Herron, D. Leach, J. Olsen, J. L. Osborne, and V. Zeps 1985 3 p refs Presented at the 6th International Symposium on Polarization Phenomena in Nuclear Physics, Osaka, Japan, 26 Aug. 1985
(Contract DE-AC06-81ER-40048)
(DE86-000534; DOE/ER-40048/146; CONF-850807-8) Avail: NTIS HC A02/MF A01

This ion source was to be purchased from ANAC, Inc., a New Zealand-based supplier of beam optics hardware and atomic beam polarized ion sources in December 1982. Shortly before scheduled delivery ANAC went into receivership. During 1983 little work was done on the project as various steps were taken by us, first to get the ion source completed at ANAC, and then, failing that, to obtain the existing parts. In early 1984 we began work to finish the ion source in Seattle. The project is nearly complete, and this article presents progress to date. DOE

N86-17115# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
OBSERVATION OF HADRONICALLY PRODUCED CHARMED F-MESONS
E. Belau (Institute of Nuclear Physics, Cracow, Poland), T. Boehringer (CERN, Geneva, Switzerland), M. Bosman (CERN, Geneva, Switzerland), V. Chabaud (CERN, Geneva, Switzerland), C. Damerell (Science Research Council, Chilton, England), C. Daum, G. deRijk, H. A. Dijkstra, A. Gillman (Science Council, England), and R. Gilmore (Bristol Univ., England) Jun. 1985 16 p refs Presented at International Conference on Hadron Spectroscopy, College Park, Md., 20-22 Apr. 1985
(NIKHEF-H/85-5; B8569272) Avail: NTIS HC A02/MF A01

Using the NA11 spectrometer, together with a telescope of high resolution microstrip detectors, 12 charmed F-meson decays into KK pi on an estimated background of 4 were measured. The average mass is (1972 + or - 2) MeV, the lifetime (3.1 + 1.2 or - 0.8) times 10 to the minus 13th power sec. Author (ESA)

N86-17116# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
CALCULATION OF THE DECAY mu(-)YIELDS e(-)e(+)e(-)nu SUB mu nu bar SUB C
Paul M. Fishbane (Virginia Univ., Charlottesville) and K. J. F. Gaemers Jun. 1985 21 p refs
(NIKHEF-H/85-8; B8569271) Avail: NTIS HC A02/MF A01

The family mixing process mu(-) yields e(-) e(+) e(-)nu sub mu nu bar sub e, encountered in the standard model of electroweak interactions was evaluated. The evaluation was used to check the results of Bardin et al (1972), to improve the statistics, and to provide a source for distributions. The process is evaluated with currents other than those of the standard model (SM), to provide an experimental check on the SM. Cases where the electron has a charged current V-A but the mu has a current V + alpha A, and where the muon and electron have charged currents of the form V + alpha A are considered. The SM is recovered in the limit alpha = minus 1. Author (ESA)

N86-16445# University of Electro-Communications, Tokyo (Japan). Dept. of Materials Science.
METHOD FOR PRECISELY COMPUTING MOLECULAR INTEGRALS OVER STOS WITH n=I
Noboru Suzuki *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 49-60 refs (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-17117# Fermi National Accelerator Lab., Batavia, Ill.
FERMILAB TEVATRON HIGH LEVEL RF ACCELERATING SYSTEMS
Q. Kerns, C. Kerns, H. Miller, S. Tawser, J. Reid, R. Webber, and D. Wildman Jun. 1985 4 p Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(DE85-017445; FNAL-TM-1329; CONF-850504-264) Avail: NTIS HC A02/MF A01

Eight tuned RF cavities have been installed and operated in the F0 straight section of the Tevatron. Their mechanical placement along the beam line enables them to be operated for colliding beams as two independent groups of four cavities, group 1-4 accelerating antiprotons and group 5-8 accelerating protons. The only difference is that the spacing between cavities 4 and 5 was increased to stay clear of the F0 colliding point. The cavities can easily be rephased by switching cables in a low-level distribution system (fan-out) so that the full accelerating capability of all eight cavities can be used during a fixed target operations. Likewise, the cables from capacitive probes on each cavity gap can be switched to proper lengths and summed in a fan-back system to give an RF signal representing the amplitude and phase as seen by the beam separately for protons and antiprotons. Such signals have been used to phase lock the Tevatron to the Main Ring for synchronous transfer. DOE

N86-17118# Fermi National Accelerator Lab., Batavia, Ill.
STATISTICS OF DIPOLE STEERING IN THE TEVATRON
M. J. Syphers Jun. 1985 4 p Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-03000)
(DE85-017438; FNAL-TM-1324; CONF-850504-265) Avail: NTIS HC A02/MF A01

Methods of calculating the expected rms orbit distortion and the expected peak orbit distortion for a large FODO synchrotron are described. An expression for the expected rms correction element dipole strength necessary to correct the closed orbit of a large FODO synchrotron is derived. The uncorrected closed orbit of the FNAL Tevatron accelerator is determined from beam position data and operational settings of the correction element diode magnets. The uncorrected orbit and correction element dipole strengths are compared to the results of the Tevatron design study. Use of these expressions for SSC lattices is discussed. DOE

N86-17119# Fermi National Accelerator Lab., Batavia, Ill.
DESIGN, INSTALLATION AND COMMISSIONING OF THE DO OVERPASS AT THE FERMILAB MAIN RING
R. Gerig, M. May, C. Moore, S. Ohnuma, S. Pruss, and F. Turkot Jun. 1985 4 p Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-03000)
(DE85-016986; FNAL-TM-1317; CONF-850504-249) Avail: NTIS HC A02/MF A01

In order to accommodate large detectors for anti pp studies at the Tevatron, the Main Ring has been modified to be non-planar. A 700 foot-long portion of the ring has been reworked to create an overpass which displaces the beam orbit upwards by 51 inches at the DO long straight section. The overpass region follows the screw geometry proposed by T. Collins. A set of four vertically bending dipoles were inserted into the Main Ring lattice; they are powered on a separate bus and operate at twice the current and field level of a standard bend. To make space for these vertical bends, at each vertical bend point two of the four standard dipoles in a half-cell are removed and the other two are powered at twice the current and field level of the rest of the ring. The vertical bends also have a set of trim coils powered by a separate supply so that any difference in the horizontal and vertical bending strengths can be compensated. The DO overpass was commissioned with beam in November to December 1984. The principal effect on beam dynamics predicted and observed is the introduction of momentum dispersion in the vertical dimension of peak value 1.9m. To preserve closed orbit quality during acceleration, the vertical bends must track the rest of the ring with a precision of better than 0.1%. The Main Ring-Tevatron complex has now been running the fixed-target program for four months; the impact of the DO overpass on accelerator performance has been minimal. DOE

N86-17120# Fermi National Accelerator Lab., Batavia, Ill.
LINEAR APERTURE CRITERIA FOR A STANDARD CELL LATTICE
N. M. Gelfand Jul. 1985 13 p
(Contract DE-AC02-76CH-03000)
(DE85-017365; FNAL-TM-1338) Avail: NTIS HC A02/MF A01

Among the parameters which need to be specified in the design of the SSC are the cell length (1 sub c) and the coil diameter (d sub c). The quality of the magnetic field of the bending magnets, reflected in both small multipole coefficients and a small sigma for these coefficients, improve as d sub c increases. Similarly the smaller beta resulting from a decreased 1 sub c results in an increased admittance (for a constant size beam pipe). Unfortunately increasing d sub c and or 1 sub c would result in increasing the cost of the SSC. It is not only desirable but necessary to understand how the performance of an accelerator depends on d sub c and 1 sub c so that we can have confidence that the SSC when built will work. It should be straightforward to know whether or not an accelerator, once built, works or not. There are, however, no well accepted tools or criteria for deciding whether or not a proposed design of an accelerator will provide acceptable performance. This is particularly so in the case of accelerators built of superconducting magnets in which the magnetic field is determined by the current distribution in the coils. DOE

N86-17121# Los Alamos National Lab., N. Mex.
LAMPF 2 CAPABILITIES FROM AN EXPERIMENTER'S VIEWPOINT
R. J. Macek 1985 35 p refs Presented at the Workshop on Nuclear and Particle Physics at Intermediate Energies with Hadrons (ICTP), Trieste, Italy, 1 Apr. 1985
(Contract W-7405-eng-36)
(DE85-015676; LA-UR-85-2352; CONF-8504169-1) Avail: NTIS HC A03/MF A01

LAMPF 2 has been proposed to extend the intensity frontier of nuclear and particle physics from about 1 GeV to 45 GeV. It is reviewed here with emphasis on capabilities of the experimental facilities. Major accelerator features, costs, and the choice of energy and current are also discussed. DOE

N86-17122# Mound Lab., Miamisburg, Ohio.
ENERGY RESPONSE OF THE DEPANGHER PRECISION LONG COUNTER
M. E. Anderson and J. DePangher 28 Aug. 1985 13 p refs
(Contract DE-AC04-76DP-00053)
(DE85-016980; MLM-3287) Avail: NTIS HC A02/MF A01

The location of the effective center of a long counter is energy dependent and, therefore, the energy response of the counter is a function of both energy and source-detector separation. This report reemphasizes this fact and includes a corrected version of the original energy response curve for the precision long counter. DOE

N86-17123# California Univ., Berkeley. Lawrence Berkeley Lab.
PROGRAM PLAN FOR THE MBE-4 MULTIPLE BEAM EXPERIMENT
R. T. Avery Feb. 1985 76 p
(Contract DE-AC03-76SF-00098)
(DE85-016489; LBL-19592) Avail: NTIS HC A05/MF A01

The technical description treats the arrangement of the injector

system (made up of an existing high voltage Marx generator, a new four-beam source array and a beam conditioning unit for matching and steering) and the accelerator apparatus which contains the 24 shaped-pulsed accelerating units. Flexibility in diagnostic capability and physics experiments has been maintained insofar as possible. DOE

N86-17124# Stanford Linear Accelerator Center, Calif.
PION-SKYRMION SCATTERING: COLLECTIVE COORDINATES AT WORK
M. E. Pekin Jun. 1985 22 p refs Presented at the Symposium on the Recent Developments in Quantum Field Theory, Copenhagen, Denmark, 6 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-014957; SU-SLAC-PUB-3703; CONF-8505192-1) Avail: NTIS HC A02/MF A01

It is argued that the Skryme model, and more generally, the picture of the nucleon as a chiral soliton, can give a qualitatively correct picture of pion-nucleon scattering, considering both group-theoretic and more scheme-dependent results. The properties of the nucleon and its excited states in large-N quantum chromodynamics are discussed qualitatively. Then the pion-nucleon S-matrix is reduced. It is found that the model succeeds at the first level of calculation in producing many of the features of pion-nucleon scattering which are revealed by experiment, but that many aspects of the description need to be better understood, including the treatment of nonleading corrections near threshold and the inclusion of inelastic channels. DOE

N86-17125# Los Alamos National Lab., N. Mex.
TOWARD A MICROSCOPIC UNDERSTANDING OF THE INTERACTING BOSON MODEL OF NUCLEI
J. N. Ginocchio 1985 39 p refs Presented at the 3rd Capri Symposium on Symmetry and Supersymmetry in Nuclear and Subnuclear Physics, Capri, Italy, 20 May 1985
(Contract W-7405-eng-36)
(DE85-015735; LA-UR-85-2704; CONF-8505190-1) Avail: NTIS HC A03/MF A01

Fermion shell model Hamiltonians are constructed which have a class of eigenstates composed of monopole pairs and quadrupole pairs only. Since no boson approximation needs to be made, the Pauli principle is kept intact. Because the SO8 model has a one-to-one correspondence between the space spanned by the fermion states composed of the special monopole and quadrupole pairs of neutrons and protons and the space spanned by the monopole and quadrupole bosons, it is discussed in detail. Recent developments in the Sp6 model are also reported. These two models classify all the shell model states by the number of identical fermion pairs not coupled to coherent monopole or quadrupole pairs. It is suggested that light nuclei may combine features of both SU3 and SO6 symmetry simultaneously. DOE

N86-17126# Brookhaven National Lab., Upton, N. Y.
EXPERIMENTS IN THE FRAGMENTATION REGIONS
M. A. Faessler, P. D. Bond, and L. Remsberg 1985 15 p refs Presented at the Workshop on Experiments for RHIC, Upton, N.Y., 15 Apr. 1985 Prepared in cooperation with European Organization for Nuclear Research, Geneva, Switzerland
(Contract DE-AC02-76CH-00016)
(DE85-016063; BNL-36780; CONF-8504152-6) Avail: NTIS HC A02/MF A01

The fragmentation region is generally defined as the rapidity range where most of the valence partons of the incoming hadrons (or nuclei) are found after normal inelastic interactions. The disadvantages of the existing intersection region for fragmentation region studies are discussed and a slightly modified design is proposed which allows study of the fragmentation region. The considerations which led to the design of a spectrometer magnet are then outlined and some approaches to specific experiments are detailed. DOE

N86-17127# Duke Univ., Durham, N. C. Dept. of Physics.
STUDIES OF INTERACTIONS BETWEEN ELEMENTARY PARTICLES AND NUCLEI Progress Report
1 Aug. 1985 37 p
(Contract DE-AS05-76ER-03065)
(DE85-016572; DOE/ER-03065/50) Avail: NTIS HC A02/MF A01

Data analysis was performed on these four completed experiments: resonance production in (PI)(+)p interactions at 15.7 GeV/c, vector meson production from (GAMMA)p interactions at 20 GeV, particle-nucleus interactions at 100 GeV/, and a search for glueballs in (PI)(-)p yields nK sub s K sub s (PI) (0) at 25 GeV/c and a measurement of hyperon radiative decays. Progress is also reported on these experiments: charm particle production from pp interactions at 400 and 800 GeV/c, direct photon and charmonium production from 300 GeV/c ((PI) (+-), K(+1), p(+-)) d interactions, and a search for a quark-gluon plasma in anti pp collisions at (RADICAL)s - 2 TeV. DOE

N86-17128# Stanford Linear Accelerator Center, Calif.
LINEAR COLLIDERS: PROSPECTS 1985
J. Rees Jun. 1985 9 p refs Presented at the International Europhysics Conference on High Energy Physics, Bari, Italy, 18 Jul. 1985
(Contract DE-AC03-76SF-00515)
(DE85-015259; SU-SLAC-PUB-3713; CONF-850721-1) Avail: NTIS HC A02/MF A01

We discuss the scaling laws of linear colliders and their consequences for accelerator design. We then report on the SLAC Linear Collider project and comment on experience gained on that project and its application to future colliders. DOE

N86-17129# Pacific Northwest Lab., Richland, Wash.
BETA FIELD MEASUREMENTS AT DOE FACILITIES
L. A. Rathbun, K. L. Swinth, D. L. Haggard, and R. A. Fox Apr. 1985 19 p Presented at the Health Physics Society Annual Meeting, Chicago, Ill., 26 May 1985
(Contract DE-AC06-76RL-01830)
(DE85-013277; PNL-SA-12887; CONF-8505103-5) Avail: NTIS HC A02/MF A01

Beta fields encountered at DOE facilities were characterized and the effects of mixed field radiations on various radiation monitoring devices studied. DOE

N86-17130# Oak Ridge National Lab., Tenn.
SPECIAL PURPOSE MATERIALS FOR MAGNETICALLY CONFINED FUSION REACTORS Annual Progress Report
May 1985 66 p
(Contract DE-AC05-84OR-21400)
(DE85-013529; DOE/ER-0113/4; APR-7) Avail: NTIS HC A04/MF A01

Special purpose materials for magnetically confined fusion reactors are examined as part of the fusion reactor materials program. G.L.C.

N86-17131# Los Alamos National Lab., N. Mex.
PREDICTING FUEL PERFORMANCE FOR SP-100 CONDITIONS
R. E. Baars 1985 8 p Presented at the 2nd SP-100 Program Integration Meeting, Denver, Colo., 17 Sep. 1985
(Contract W-7405-eng-36)
(DE85-017337; LA-UR-85-3005; CONF-8509153-1) Avail: NTIS HC A02/MF A01

This paper reports on methods for analyzing fuel designs proposed for the thermionic and thermoelectric concepts for SP-100 application. The proposed fuel design for the thermionic concept consisted of fully-enriched oxide fuel clad in chemical vapor deposition (CVD) tungsten, which also served as the emitter for the thermionic fuel element (TFE). The fuel density was 95% of theoretical with the linear heat rate flattened radially by removing fuel from the center of the fuel pellet. The fuel inner diameter varied from approx. 0.45 in. at the core center to zero at the edge of the core. The as-fabricated gap between fuel and emitter was 10 mils radial. The emitter thickness was 80 mils, and the outer diameter was 1.099 in. The LIFE-4 code was used for evaluation of this concept after extensive review of the code and

development of a procedure that corrects certain deficiencies noted in analysis of several tests. DOE

N86-17132# California Univ., Berkeley. Lawrence Berkeley Lab.
DEVELOPMENTS IN ACCELERATORS FOR HEAVY ION FUSION
D. Keefe May 1985 8 p refs Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-017645; LBL-19601; CONF-850504-278) Avail: NTIS HC A02/MF A01

The long term goal of Heavy Ion Fusion (HIF) is the development of an accelerator with the large beam power, large beam stored-energy, and high brightness needed to implode small deuterium-tritium capsules for fusion power. While studies of an RF linac/storage ring combination as an inertial fusion driver continue in Japan and Europe, the US program in recent times has concentrated on the study of the suitability of linear induction acceleration of ions for this purpose. Novel features required include use of multiple beams, beam current amplification in the linac, and manipulation of long beam bunches with a large velocity difference between head and tail. Recent experiments with an intense bright beam of cesium ions have established that much higher currents can be transported in a long quadrupole system than was believed possible a few years ago. A proof-of-principle ion induction linac to demonstrate beam current amplification with multiple beams is at present being fabricated at LBL. DOE

N86-17133# Fermi National Accelerator Lab., Batavia, Ill.
SUPERCOLLIDER PHYSICS
C. Quigg Mar. 1985 20 p refs Presented at the International Symposium on Physics of Proton-Antiproton Collision, Tsukuba, Japan, 13 Mar. 1985
(Contract DE-AC02-76CH-03000)
(DE85-012305; FNAL/C-85/46-T; CONF-8503151-3) Avail: NTIS HC A02/MF A01

The physics that can be explored with multi-TeV supercolliders is reviewed, including parton distributions, hadron jet production, the standard electroweak theory and minimal extensions to it, technicolor, supersymmetry, and compositeness. DOE

N86-17134# Brookhaven National Lab., Upton, N. Y.
APIPIS: THE ATOMIC PHYSICS ION-PHOTON INTERACTION SYSTEM
B. M. Johnson, K. W. Jones, M. Meron, and V. O. Kostroun 1985 7 p Presented at the 3rd Workshop on Electron Beam Ion Sources and Their Applications, Ithaca, N.Y., 20 May 1985 Prepared in cooperation with Cornell Univ., Ithaca, N.Y.
(Contract DE-AC02-76CH-00016)
(DE85-018483; BNL-36925; CONF-8505203-2) Avail: NTIS HC A02/MF A01

A proposed new facility for the study of highly charged heavy ions is described. The basic elements of APIPIS, the Atomic Physics Ion-Photon Interaction System, are: (1) a source of multiply-charged ions; (2) a linear accelerator; (3) a synchrotron storage ring; and (4) a source of high brightness X-rays. The placement of a heavy ion storage ring at the X-ray ring of the National Synchrotron Light Source will provide unique opportunities for the study of photo-excitation of heavy ions. DOE

N86-17135# Brookhaven National Lab., Upton, N. Y.
X-RAY SPECTRA FROM THE CORNELL ELECTRON-BEAM ION SOURCE (CEBIS 1)
B. M. Johnson, K. W. Jones, V. O. Kostroun, E. Ghanbari, and S. W. Janson 1985 7 p ref Presented at the 3rd Workshop on Electron Beam Ion Sources and Their Applications, Ithaca, N.Y., 20 May 1985 Prepared in cooperation with Cornell Univ., Ithaca, N.Y.
(Contract DE-AC02-76CH-00016)
(DE85-018484; BNL-36927; CONF-8505203-1) Avail: NTIS HC A02/MF A01

Radiation emitted from the Cornell electron beam ion source (CEBIS 1) has been surveyed with a Si(Li) X-ray detector. These spectra can be used to estimate backgrounds from electron bremsstrahlung and to evaluate the feasibility of atomic physics experiments using the CEBIS 1 source in this configuration. DOE

N86-17136# Brookhaven National Lab., Upton, N. Y.
USE OF GRADIENT MAGNETS IN LOW EMITTANCE ELECTRON STORAGE RINGS
G. Vignola 1985 14 p Presented at the 2nd International Synchrotron Radiation Instrumentation Conference, Stanford, Calif., 29 Jul. 1985
(Contract DE-AC02-76CH-00016)
(DE85-018565; BNL-36867; CONF-850734-3) Avail: NTIS HC A02/MF A01

The use of gradient magnets for a low emittance electron storage ring is discussed and a magnetic lattice for a 6 GeV electron energy synchrotron radiation source adopting this feature is presented. DOE

N86-17137# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
[ACTIVITIES REPORT IN NUCLEAR AND HIGH ENERGY PHYSICS] Annual Report, 1984
1984 112 p refs
Avail: NTIS HC A06/MF A01

High energy physics research using particle accelerators is summarized. Electron scattering; experiments concerning pions, muons, and antiprotons; theoretical physics; radiochemistry; and technical aspects of the accelerators and associated equipment are discussed. Author (ESA)

N86-17138# Groningen Rijksuniversiteit (Netherlands). Kernfysisch Versneller Inst.
[ACTIVITIES REPORT OF THE INSTITUTE OF NUCLEAR PHYSICS] Annual Report, 1984
J. F. W. Jansen, ed. and R. A. R. L. Malfliet, ed. 1984 146 p refs
Avail: NTIS HC A07/MF A01

Research in experimental nuclear physics; theoretical nuclear physics; atomic and surface physics; nuclear solid state physics; nuclear medicine; environmental physics; and cyclotron based areas is summarized. Instrumentation and electronics, and data analysis and acquisition systems are described. Author (ESA)

74 OPTICS

Includes light phenomena.

N86-17139 Department of the Air Force, Washington, D.C.
METHOD AND APPARATUS FOR GENERATING A STRUCTURED LIGHT BEAM ARRAY Patent
J. Taboada and B. R. Altschuler, inventors (to Air Force) Issued 18 Jun. 1985 9 p Supersedes AD-D011590
(AD-D011899; US-Patent-4,523,809; US-Patent-Appl-SN-520356; US-Patent-Class-350-163) Avail: US Patent and Trademark Office CSCL 20/6

An apparatus is described for simultaneously generating a space volume-filling structural light beam array. It utilizes a prism assembly which refracts a laser light beam so as to partition it into four separate segments. The four segments produced the two-by-two rectangular beam array by coherent interference of the segments. Author (GRA)

N86-17140*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SINGLE SCATTERING FROM NONSPHERICAL CHEBYSHEV PARTICLES: A COMPENDIUM OF CALCULATIONS
Warren J. Wiscombe and Alberto Mugnai (Colorado State Univ., Fort Collins) Jan. 1986 282 p refs
(NASA-RP-1157; Rept-613; NAS 1.61:1157) Avail: NTIS HC A13/MF A01 CSCL 20F

A large set of exact calculations of the scattering from a class of nonspherical particles known as Chebyshev particles' has been

performed. Phase function and degree of polarization in random orientation, and parallel and perpendicular intensities in fixed orientations, are plotted for a variety of particles shapes and sizes. The intention is to furnish a data base against which both experimental data, and the predictions of approximate methods, can be tested. The calculations are performed with the widely-used Extended Boundary Condition Method. An extensive discussion of this method is given, including much material that is not easily available elsewhere (especially the analysis of its convergence properties). An extensive review is also given of all extant methods for nonspherical scattering calculations, as well as of the available pool of experimental data. Author

N86-17141*# Pittsburgh Univ., Pa.
A STUDY OF THE POLARIZATION OF LIGHT SCATTERED BY VEGETATION M.S. Thesis
Paul Norman Woessner 1985 94 p refs
(Grant NAG5-378)
(NASA-CR-176452; NAS 1.26:176452) Avail: NTIS HC A05/MF A01 CSCL 20F

This study was undertaken in order to better understand the factors that govern the polarization of light scattered from vegetation and soils. The intensity and polarization of light scattered by clover and grass in vivo and soil were measured at a number of different angles of incidence and reflectance. Both individual leaves and natural patches of leaves were measured. The light transmitted through the leaves was found to be negatively polarized. The light scattered from the upper leaf surface was found to be positively polarized in a manner which could be accounted for qualitatively but not quantitively by the Fresnel reflection coefficients modified by a shadowing function of the form cos sup2 (g/2), where g is the phase angle. Findings indicate that the polarization of light scattered by vegetation is a more complex process than previously thought, and that besides the surface-scattered component of light, the volume-scattered and multiply-scattered components also contribute significantly to the polarization. Author

N86-17142# California Univ., San Diego. Dept. of Electrical Engineering and Computer Sciences.
RESEARCH ON MATERIALS AND COMPONENTS FOR OPTO-ELECTRONIC SIGNAL PROCESSING Final Report, 1 Oct. 1979 - 30 Sep. 1984
W. S. C. Chang, J. M. Delavaux, S. Forouhar, C. C. Sun, and T VanEck 1 Oct. 1984 53 p
(Grant AF-AFOSR-0037-80)
(AD-A159122; AFOSR-85-0659TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

Design of chirped grating lenses on optical waveguides for opto-electronic signal processing is presented in this report. Fundamental limitations of the performance of chirped grating lenses due to material properties, fabrication tolerance and design parameters are discussed. In addition, electro-absorption and electro-refraction properties in GaAs and InP semiconductors are presented. Cross modulation of optical radiations at two different wavelengths has been observed in GaAs. It has the potential of exhibiting optical and logic. GRA

N86-17143# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A REGULARIZED SOLUTION TO EDGE DETECTION
T. Poggio, H. Voorhees, and A. Yuille May 1985 24 p
(AD-A159349; AI-M-833) Avail: NTIS HC A02/MF A01 CSCL 20/8

The authors consider edge detection as the problem of measuring and localizing changes of light intensity in the image. Edge detection does not have a precisely defined goal. The word edge itself, which refers to physical properties of objects, is somewhat of a misnomer. Several years of experience have shown that the ideal goal of detecting and locating physical edges in the surfaces being imaged is very difficult and still out of reach. Edge detection has come to be defined as the first step toward this goal of detecting physical changes such as object boundaries. Other processes which operate on these measurements of intensity changes will then group boundaries and label and characterize them in terms of the properties of the 3-D surfaces. Intended in this narrow sense, edge detection - this first step in processing the image - is mainly the process that measures, detects and localizes changes of intensity. Derivatives must be estimated correctly to label the critical points in the image intensity array, characterize their local properties (are they minima or maxima or saddle points?) and thus relate them to the underlying physical process (are they shadow edges or depth discontinuities?). GRA

N86-17144# Sandia National Labs., Albuquerque, N. Mex.
BULKHEAD INTERFACE CHASSIS FOR OPTICAL FIBER PATCHING
M. George Jun. 1985 24 p
(Contract DE-AC04-76DP-00789)
(DE85-017320; SAND-85-0867) Avail: NTIS HC A02/MF A01

An optical fiber patch panel was designed to meet the changing needs of optical fiber communication link installations. This paper deals with the specification and construction details of the Bulkhead Interface Chassis patch panel. Included is ordering information for the commercial parts needed and shop drawings of the pieces to be machined. DOE

N86-17145# Los Alamos National Lab., N. Mex.
SYNCHROTRON BASED MEASUREMENTS OF THE SOFT X-RAY PERFORMANCE OF THIN FILM MULTILAYER STRUCTURES
D. R. Kania, R. J. Bartlett, and W. J. Trela 1985 21 p Presented at the Application of Thin Filmed Multilayered Structures To Figured X-ray Optics, San Diego, Calif., 18 Aug. 1985
(Contract W-7405-eng-36)
(DE85-015679; LA-UR-85-2349; CONF-8508104-1) Avail: NTIS HC A02/MF A01

Using synchrotron radiation, a measuring system has been developed to test the performance of layered synthetic microstructures (LSMs) from 50 to 500 eV. The measurement techniques are reviewed, and results are compared to theoretical predictions of LSM performance. DOE

N86-17146# Brigham Young Univ., Provo, Utah. Dept. of Physics and Astronomy.
IMAGE QUALITY OF FIGURED MULTILAYERED OPTICS
B. G. Peterson, L. V. Knight, and H. K. Pew 1985 12 p Presented at the SPIE International Technical Symposium on Optical and Electro-optical Engineers, San Diego, Calif., 18 Aug. 1985
(Contract DE-AS08-84DP-40199)
(DE85-017252; CONF-850887-27) Avail: NTIS HC A02/MF A01

The reflectivity and resolution of a multilayer structure is strongly affected by the roughness at the interfaces between two successive layers and by the amount that the constituent materials will diffuse into one another at the interfaces. Performance is also affected by the variations in individual layer thicknesses and by inhomogeneities in the materials. These deviations from the ideal multilayer will also affect the quality of the image from a figured multilayer optical element. The theory used to model the effects of non-ideal multilayers on the image quality of figured optics will be discussed. The relationship between image quality and multilayer structure quality will be illustrated with several examples. DOE

N86-17147# Colorado Univ., Boulder.
LIGHT SCATTERING STUDIES OF LOWER DIMENSIONAL COLLOIDAL PARTICLE AND CRITICAL FLUiD SYSTEMS Final Progress Report
W. J. OSullivan and R. C. Mockler Aug. 1985 21 p
(Contract DE-AC02-82ER-13004)
(DE86-000212; DOE/ER-13004/3) Avail: NTIS HC A02/MF A01

We have completed a program of small angle scattering Rayleigh linewidth measurements on thin films of a 2,6-lutidine + water mixture. No statistically significant departures from three dimensional dynamic response were seen, although the conditions set by the theory of Calvo and Ferrell were met. We have applied digital image processing to evaluate fractal scale invariance in

two dimensional particle aggregates arising from the induced coagulation of colloidal particle monolayer crystals. Our system gives us the capability of calculating the pair correlation function for both small and very large (20,000 particles) particle clusters. We find evidence of an apparent crossover between kinetic clustering aggregation at small distances (about 20 particle diameters) to percolation or gel/sol transition-behavior at large distances. This is evident in both isolated clusters and in final state giant aggregates. We are carrying through a parallel program of computer calculations whose motivation is to assess the sensitivity of experimental measures of self similarity to cluster size and image resolution, and to generate efficient algorithms which can be applied to calculate fractal critical exponents other than the Hausdorff dimension. We have succeeded in measuring the surface tension of a water surface covered by a colloidal particle monolayer crystal, in both its repulsive-dipole and close-packed van der Waals phases. DOE

N86-17148# Royal Observatory, Edinburgh (Scotland).
THE UK SCHMIDT TELESCOPE OBJECTIVE PRISMS. PART 1: THEIR APPLICABILITY TO SOME MODERN RESEARCH PROJECTS
Ann Savage, Steven M. Beard (Edinburgh Univ.), and John B. Palmer (Edinburgh Univ.) 1985 24 p refs
(ISBN-0-902553-34-8-Pt-1) Avail: NTIS HC A02/MF A01

United Kingdom Schmidt Telescope (UKST) prism applications are summarized. Quasar searches over several square degrees yield sufficiently large samples to allow three-dimensional superclustering studies on 100 to 500 Mpc scales to be made. Surveys for emission-line galaxies and extragalactic HII regions are useful for detailed astrophysical studies on the populations of galaxies found. Surveys to probe the large scale distribution of galaxies, to detect voids and superclustering, are possible from UKST plates. Surveys for emission-line stars, particularly planetary nebulae in the Magellanic Clouds and H alpha emission stars in the Orion star formation region, are described. Detailed spectral classification is possible off the UKST prism plate material thus making searches for specific spectral classes relatively easy, and permitting all stars in large areas of sky to be spectrally classified. Author (ESA)

N86-16582# Joint Publications Research Service, Arlington, Va.
FIELD DISTRIBUTION IN A BENT SINGLE-MODE OPTICAL FIBER
Bao Zhenwu *In its* China Report: Science and Technology (JPRS-CST-85-041) 10 Dec. 1985 p 84-91 refs Transl. into ENGLISH from Tianjin Daxue Xuebao (Tianjin, China), no. 4, Dec. 1984 p 97-102 (For primary document see N86-16573 07-36) Avail: NTIS HC A07/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-17149 California Univ., Berkeley.
LOCALIZED NONLINEAR ELECTROSTATIC WAVES IN THE AURORAL PLASMA Ph.D. Thesis
Earl Frederick Witt 1984 234 p
Avail: Univ. Microfilms Order No. DA8513046

A significant problem in auroral physics is understanding the process that accelerates auroral zone particles to kilovolt energies. Observations by the polar orbiting S3-3 satellite have identified two distinct types of localized electric field structures below 8000 km that are associated with the acceleration process. Groups of localized potential jumps along the magnetic field lines, called double layers, and associated symmetric potential wells or bumps, called solitary waves, have been observed to propagate along auroral field lines at speeds greater then 50 km/s. The electric field of these structures is directed along the magnetic field, and is small (< 15 mV/m). In contrast to these small amplitude structures, there are the slowly moving electrostatic shocks which consist of localized regions of intense (100 to 1000 mV/m) electric field that is directed at large angles to the magnetic field. To better understand the physics underlying these structures, several electrostatic models of these waves are developed. Dissert. Abstr.

N86-17150# Nagoya Univ. (Japan). Inst. of Plasma Physics.
IS THE DRIFT INSTABILITY RELATED TO H-MODE?
Kouichi Jimbo Oct. 1985 14 p refs
(IPPJ-745) Avail: NTIS HC A02/MF A01

The physical mechanism of the drift instability is reconsidered related to the H-mode in poloidal diverter tokamak plasma. The collisionless drift wave is stabilized as a result of the quasilinear modification of the ion velocity distribution function which includes the particle drift terms along the magnetic field in the scrape-off plasma near the separatorix of the poloidal divertor tokamak. A freedom in the direction of magnetic field can stabilize the drift instability. The heat flux deposited to the divertor plate is expected to increase after H-mode transition. Author

N86-17151# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STOPPING POWER THEORIES FOR CHARGED PARTICLES IN INERTIAL CONFINEMENT FUSION PLASMAS (EMPHASIS ON HOT AND DENSE MATTERS)
Shosuke Karashima, Tsutomu Watanable, Takako Kato, and Hiroyuki Tawara Sep. 1985 115 p refs
(IPPJ-AM-42) Avail: NTIS HC A06/MF A01

The theoretical approaches on the stopping power of the charged particles penetrating through matters are reviewed. Particular attention is paid to the problems of the energy losses of projectile ions in hot and dense plasmas in the study of inertial confinement fusion (ICF). General physical and mathematical treatments are also outlined. Author

N86-17152# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PARTICLE FLUXES IN THE BANANA REGIME DUE TO RF WAVE INJECTION
Masayoshi Taguchi Sep. 1985 13 p refs
(IPPJ-744) Avail: NTIS HC A02/MF A01

The radial particle fluxes for a two ion species plasma are investigated in an axisymmetric toroidal magnetic field. As a wave-absorption mechanism, the ion-cyclotron damping is considered. The inward and outward fluxes of plasma ions and impurity ions are induced by the RF wave injection when the condition U sub 0 B sub 0 > 0 is satisfied. Here U sub 0 is the phase velocity along the magnetic field and B sub theta is the poloidal magnetic field. Author

N86-17153# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ROTATIONAL STRUCTURE OF FIELD REVERSED CONFIGURATION (FRC) PLASMA PRODUCED BY THETA PINCH
Yoshiyuki Aso Aug. 1985 21 p refs Presented at the 37th Annual Meeting of SBPC, Belo Horizonte, Brazil, 10-17 Jul. 1985
(INPE-3622-PRE/806) Avail: NTIS HC A02/MF A01

The rotation of the plasma with a field reversed configuration (FRC) was observed in STP-L (Staged Theta Pinch-Linear) experiments in Nagoya University. The produced plasma in this experiment can be divided into three parts, i.e., the core plasma (FRC plasma), its surrounding halo plasma and the escaping guide plasma. The rotation of each plasma was measured from the Doppler shift of CV-spectral line, the relative ion current and the streak photographs, respectively. As a result, it is shown that the behavior of plasma rotation changes from the double structure to the triple structure when the plasma is all detached from the discharge tube, and that the FRC plasma in the early phase is rotating in the direction of electron diamagnetic current, even if the plasma touches at the discharge tube. Author

N86-17154# California Univ., Berkeley. Electronics Research Lab.
ON PLASMA THEORY AND SIMULATION Quarterly Progress

Report, 1 Jan. - 30 Jun. 1984
C. K. Birdsall 30 Jun. 1985 56 p
(Contracts N00014-77-C-0578; DE-AT03-76ET-53064; RRO-109) (AD-A156747; QPR-1; QPR-2) Avail: NTIS HC A04/MF A01 CSCL 20/9

Topics include: (1) electron Bernstein wave investigations -- simulations of driving a plasma with these waves, just off perpendicular, has begun, obtaining the predicted damping rate. The objectives are understanding, with potential application to current drive or heating; (2) simulation of plasma-sheath region, including ion reflection -- using ion reflection at a wall of 70% causes a larger drop in wall sheath potential and an increase in the field at the wall. Reflection here means re-emission, i.e., a return as half-Maxwellian; (3) single ended plasma device, general behavior dc or ac -- this paper decribes simulations with various dc biases, showing both stable states (floating, negative bias) and unstable (moderate positive bias) with periodic current disruptions (relaxation oscillations) for both electron and ion rich sources; (4) single ended plasma device, unstable states -- this paper is more detail of the instabilities in showing J(t) and phase space for the ion-rich instability; (5) corrections to time-dependent Q-machine equilibria -- in the ion-rich source, negatively biased collector simulations, the classical analysis has an electron hole at the source. However, this hole is filled in the simulations, even when the number of particles is made very large (reducing fluctuations). The corresponding filled-hole analysis fits the measured potentials and (6) multifluid derivation of the Alfven ion-cyclotron linear dispersion relation. GRA

N86-17155# STD Research Corp., Arcadia, Calif.
HYPERVELOCITY PLASMAS WITH STRONG MHD (MAGNETOHYDRODYNAMIC) INTERACTIONS Final Technical Report, 1 Jun. 1983 - 31 May 1984
S. T. Demetriades and C. D. Maxwell Dec. 1984 60 p
(Contract F49620-83-C-0115)
(AD-A158867; STDR-84-29; AFOSR-85-0667TR) Avail: NTIS HC A04/MF A01 CSCL 20/9

Use of body forces to inject energy into a plasma offers certain advantages over simple energy addition by Ohmic heating. To achieve ever-increasing levels of energy per unit mass by this strategy requires detailed and thorough understanding of high-interaction magnetohydrodynamics (HIMHD) through realistic computer simulation. Such simulation is possible by the existing, HIMHD codes provided they undergo further validation in the high-interaction regime through systematic experiments. The present work has carried out a critical assessment of several methods for achieving high-interaction, high-magnetic Reynolds number MHD flows. It indicates that continuous flow (as contrasted to pulsed flow) plasmajet-drive MHD devices offer the greatest advantages and potential for validating the STD/MHD codes at high MHD interaction over a wide range of parameters with the greatest confidence. It has led to the definition of specific plasmajet-driven experiments, utilizing existing equipment, as the most effective way to carry out this task. GRA

N86-17156# Oak Ridge National Lab., Tenn.
FEDC TRADE STUDIES: UPGRADED CAPABILITY EXISTS TO EXAMINE COST/PERFORMANCE SENSITIVITIES FOR ALL TOKAMAK OPTIONS
C. A. Flanagan 1985 30 p Presented at the Ignition Studies Mission 2 Meeting, Los Angeles, Calif., 31 Jan. 1985
(Contract DE-AC05-84OR-21400)
(DE85-006919; CONF-850148-1) Avail: NTIS HC A03/MF A01

Information from the FEDC (Fusion Engineering Design Center) trade studies is presented in viewgraph form. The existance of upgraded capabilities to examine the cost/performance sensitivities of all tokamak options were examined. DOE

N86-17157# Washington Univ., Seattle. Nuclear Physics Lab.
UNIVERSITY OF WASHINGTON SUPERCONDUCTING BOOSTER LINAC
D. W. Storm, J. F. Amsbaugh, J. G. Cramer, H. E. Swanson, T. A. Trainor, R. Vandenbosch, W. G. Weitkamp, and D. I. Will 1985 4 p refs Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract DE-AC06-84ER-40124)
(DE85-017418; DOE/ER-40124/5; CONF-850504-272) Avail: NTIS HC A02/MF A01

We have begun construction of a superconducting linac designed to accelerate ions from protons through about mass 60. Injected by out 9 MV-terminal tandem van de Graaff accelerator, the linac is expected to double the proton energy and quadruple the energies of heavier ions. The resonators are lead plated copper quarter wave structures. The overall layout and expected performance of the accelerator will be presented, along with a brief status report. DOE

N86-17158# Lawrence Livermore National Lab., Calif.
ACCELERATION OF COMPACT TORUS PLASMA RINGS IN A COAXIAL RAIL-GUN
C. W. Hartman, J. H. Hammer, and J. Eddleman 16 May 1985 5 p Presented at the 7th US Symposium on Compact Toroid Research, Santa Fe, N. Mex., 21 May 1985
(DE85-016069; UCRL-92689; CONF-8505100-18) Avail: NTIS HC A02/MF A01

We discuss here theoretical studies of magnetic acceleration of Compact Torus plasma rings in a coaxial, rail-gun accelerator. The rings are formed using a magnetized coaxial plasma gun and are accelerated by injection of B sub theta flux from an accelerator bank. After acceleration, the rings enter a focusing cone where the ring is decelerated and reduced in radius. As the ring radius decreases, the ring magnetic energy increases until it equals the entering kinetic energy and the ring stagnates. Scaling laws and numerical calculations of acceleration using a O-D numerical code are presented. 2-D, MHD simulations are shown which demonstrate ring formation, acceleration, and focusing. Finally, 3-D calculations are discussed which determine the ideal MHD stability of the accelerated ring. DOE

N86-17159# Oak Ridge National Lab., Tenn.
COMPACT DT FUSION SPHERICAL TORI AT MODEST FIELDS
Y. K. M. Peng 1985 5 p Presented at the Annual Meeting of the American Nuclear Society, Boston, Mass., 9 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016415; CONF-850610-37) Avail: NTIS HC A02/MF A01

A spherical torus is obtained by retaining only the indispensable components on the inboard side of a tokamak plasma, such as a cooled, normal conductor that carries current to produce a toroidal magnetic field. The resulting device features an exceptionally small aspect ratio (typically 2-to-1 elongation), and ramp-up and maintenance of the plasma current primary by noninductive means. The tokamak plasma takes on the spherical shape with a modest hole through the center, suggesting the name of spherical torus. This paper reviews the initial assessments of near-term DT fusion devices based on the spherical torus concept. DOE

N86-17160# Wisconsin Univ., Madison.
REVERSED FIELD PINCH: PROGRESS AND PROMISE
J. C. Sprott May 1985 15 p Presented at the 20th Intersociety Energy Conversion Engineering Conference, Miami Beach, Fla., 18 Aug. 1985
(Contract DE-AC02-76ET-53051)
(DE85-014865; DOE/ET-53051/85; CONF-850808-13) Avail: NTIS HC A02/MF A01

The Reversed Field Pinch (RFP) is a fusion reactor concept which, like the tokamak, confines the reacting plasma by the magnetic field produced in part by electrical currents flowing in the toroidally-confined plasma. Unlike the tokamak, the RFP requires very little externally-applied magnetic field, and thus offers the promise of a compact reactor with high power density which can be ohmically heated to ignition using non-superconducting magnet coils. Recent progress worldwide in RFP performance and physics understanding offers the promise of a new generation of devices which approach reactor conditions. DOE

N86-17161# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
COLLISIONAL EFFECTS ON COHERENT NONLINEAR WAVE PARTICLE INTERACTIONS AT CYCLOTRON HARMONICS
M. D. Carter, J. D. Callen, D. B. Batchelor, and R. C. Goldfinger Jun. 1985 39 p Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contracts DE-AC02-80ER-53104; DE-AC05-84OR-21400)
(DE85-016796; DOE/ER-53104/T3) Avail: NTIS HC A03/MF A01

When particle orbits are trapped very near a cyclotron harmonic resonance, the quasilinear concept of weakly perturbed, uncorrelated passages through resonance breaks down, and nonlinear effects become important. Numerical as well as analytic studies demonstrate that relativistic detuning of the resonance can be important for electrons even at low initial energies (approx. 20 eV) and that coupling to perturbed parallel motion can lead to strong interactions for values of the turning point where the wave frequency differs from a harmonic multiple of the bounce averaged gyrofrequency by an integral multiple of the bounce frequency. The resultant motion is described by large periodic energy excursions for which small angle Coulomb collisions or other randomization processes are required to realize net heating. Analytic formulae are derived describing the energy excursion behavior and heating in mildly relativistic limit. Also, a Monte Carlo numerical model of the collisional effects on the orbits has been employed to study electron heating at the second harmonic cyclotron resonance and to test the analytic results. In certain regimes of collisionality, a strong enhancement over quasilinear heating has been found. DOE

N86-17162# GT-Devices, Alexandria, Va.
MASS ACCELERATION IN A MULTI-MODULE PLASMA JET FOR IMPACT FUSION Final Report, 21 May 1984 - 21 May 1985
R. L. Burton, S. A. Goldstein, D. A. Tidman, D. W. Massey, N. K. Winsor, and F. D. Witherspoon Jul. 1985 55 p
(Contract DE-AC08-84DP-40202)
(DE85-015824; DOE/DP-40202/1) Avail: NTIS HC A04/MF A01

GT-Devices began work on multi-module mass accelerators for impact fusion in 1981. The technique employs sequentially switched high pressure plasma jets to accelerate a lightweight projectile in a circular barrel. The purpose of the work of the past 12 months was to improve the understanding of the plasma jet acceleration process, and to translate that understanding into verifiable results. Both goals have been accomplished. During the past year we conceived, designed, built and fired 325 shots on the Module Test Facility (MTF). This facility provided sufficient diagnostics to investigate a wide variety of geometries, plasmas and current pulses, so that rapid progress was made. DOE

N86-17163# Brookhaven National Lab., Upton, N. Y.
RELATIVISTIC HEAVY ION PHYSICS
O. Hansen 1985 7 p refs Presented at the Symposium on Nuclear Structure, Copenhagen, Denmark, 20 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-017522; BNL-36789; CONF-8505166-3) Avail: NTIS HC A02/MF A01

In the fall of 1986, beams of heavy ions up to A = 40 at total energies up to E = 225 GeV/nucleon will become available for experiments at CERN (60 and 225 GeV/nucleon) and at Brookhaven (15.5 GeV/nucleon). Future experiments to look for quark confinement are discussed. DOE

N86-17164# Brookhaven National Lab., Upton, N. Y.
CAN ANTIBARYONS SIGNAL THE FORMATION OF A QUARK-GLUON PLASMA
U. Heinz, P. R. Subramanian, and W. Greiner 1985 13 p Presented at the Workshop on Experiments for RHIC, Upton, N.Y., 15 Apr. 1985 Prepared in cooperation with Johann-Wolfgang-Goethe-Univ., Franfurt am Main West Germany
(Contract DE-AC02-76CH-00016)
(DE85-012262; BNL-36620; CONF-8504152-1) Avail: NTIS HC A02/MF A01

We report on recent work which indicates that an enhancement of antibaryons produced in the hadronization phase transition can signal the existence of a transient quark-gluon plasma phase formed in a heavy-ion collision. The basis of the enhancement mechanism is the realization that antiquark densities are typically a factor 3 higher in the quark-gluon plasma phase than in hadronic matter at the same temperature and baryon density. The signal is improved by studying larger clusters of antimatter, i.e., light antinuclei like anti alpha, in the central rapidity region. The effects of the transition dynamics and of the first order nature of the phase transition on the hadronization process are discussed. DOE

N86-17165# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
MAGNETOHYDRODYNAMIC POWER GENERATION Final Report, 9 Mar. 1984 - 8 Mar. 1985
C. H. Kruger, R. H. Eustis, M. Mitchner, S. A. Self, and T. Nakamura Jun. 1985 151 p
(Contract DE-AC22-84PC-70509)
(DE85-016429; DOE/PC-70509/T3) Avail: NTIS HC A08/MF A01

Experimental and theoretical research has been conducted to investigate phenomena expected to be important in the development of MHD power generation. The areas investigated were: Boundary layers and generator loss mechanisms, plasma nonuniformities and instabilities, investigation of rod electrodes, seed-slag interaction and the reactivity of coal, disk generators, and temperature diagnostic techniques for combustion MHD plasmas. Brief summaries of the principal results and their expected impact for large scale MHD generators are given: (1) Secondary flows driven by transverse Lorentz forces are predicted to be a major phenomenon in large-scale generators. We have studied this phenomenon by conducting experiments in a laboratory-scale facility in which a high magnetic interaction parameter for driving such secondary flows has been achieved by applying axial current and by maintaining low flow rates. The results of measurements of transverse velocities show that the resulting secondary flows consist of intense, large-scale vortices which convectively distort the cross-plane distribution of important plasma properties. (2) An experimental approach based on measurements of the phase difference of acoustic waves excited in an MHD generator has been successfully employed to detect changes caused by the magnetoacoustic interaction. Predictions for large-scale MHD generators, based upon this same theory, suggest that the possible detrimental effects of the magnetoacoustic interaction cannot be ignored, and must be given serious attention in the design of large-scale facilities. DOE

N86-17166# Brookhaven National Lab., Upton, N. Y.
SUMMARY OF THE WORKING GROUP ON THE CONSTRUCTION AND DEMONSTRATION OF A SIBERIAN SNAKE
L. G. Ratner and R. R. Raylman 1985 3 p Presented at a Workshop on Polarized Beams at the SSC, Ann Arbor, Mich., 10 Jun. 1985 Prepared in cooperation with Michigan Univ., Ann Arbor
(Contract DE-AC02-76CH-00016)
(DE85-016060; BNL-36782; CONF-8506173-2) Avail: NTIS HC A02/MF A01

It was recognized as long ago as the 1977 Ann Arbor Meeting on Higher Energy Polarized Proton Beams that a Siberian Snake should be built and tested in an operating accelerator. A program to accomplish this at Argonne National Laboratory (ANL) was part of a proposal to DOE to construct a small R and D accelerator at ANL. This was never implemented and between then and now many thoery papers have been written but no Proof of Principle Experiment (POPE) has been done. The present Ann Arbor workshop again strongly recommends that a POPE be implemented as soon as possible since it has important consequences for all of the new higher energy machines. This Demo Snake working group zeroed in on the Alternating Gradient Synchrotron (AGS) as the place where such a project could now be most effectively done. The AGS has a polarized beam and knowledgeable theoretical and experimental accelerator physicists who have been

working with polarized beams in accelerators for the last few years. Referring to the information contained in the introductory remarks to the working group on the characteristics of snake, we detail the necessary design for the AGS. DOE

N86-17167# Oak Ridge National Lab., Tenn.
SIMPLE PROCEDURE FOR ESTABLISHING IGNITION CONDITIONS IN TOKAMAKS
N. A. Uckan and J. Sheffield 1985 31 p Presented at the Workshop on Tokamak Start-Up, Problems and Scenarios Related to the Transient Phases of Long-Burn Operations, Erice, Italy, 14 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016149; CONF-850708-2) Avail: NTIS HC A03/MF A01

A method of establishing ignition conditions and plasma operating regimes over large regions of parameters space (r0/a, b/a, aB0(2)/q, etc.) under various physics assumptions (chi sub e, chi sub i, q sub psi, (beta sub crit, n sub crit, etc.) with a simple systematic global model is presented. Contour plots of ignition, supplementary power, and plasma heating and operating windows are generated. These are then used to analyze the potential physics design space, operating regimes, and plasma performance characteristics of small (R0 approx. 1 to 2 m), high field (B0 approx. 8 to 13 T) ignition experiments that are currently being considered by the US Tokamak Ignition Design Studies. DOE

N86-17168# Texas Univ., Austin. Inst. for Fusion Studies.
COMPRESSIBILITY EFFECTS ON IDEAL AND KINETIC BALLOONING MODES AND ELIMINATION OF FINITE LARMOR RADIUS STABILIZATION
M. Kotschenreuther Jul. 1985 69 p
(Contract DE-FG05-80ET-53088)
(DE85-017162; IFSR-172) Avail: NTIS HC A04/MF A01

The dynamics of ideal and kinetic ballooning modes are considered analytically including parallel ion dynamics, but without electron dissipation. For ideal modes, parallel dynamics predominantly determine the growth rate when beta is within approx. 30% of the ideal threshold, resulting in a substantial reduction in growth rate. compressibility also eliminates the stabilization effects of finite Larmor radius (FLR); FLR effects (when temperature gradients are neglected) can even increase the growth rate above the MHD value. Temperature gradients accentuate this by adding a new source of free energy independent of the MHD drive, in this region of ballooning coordinate corresponding in MHD to the continuum. Analytic dispersion relations are derived demonstrating the effects above; the formalism emphasizes the similarities between the ideal MHD and kinetic cases. DOE

N86-17169# Stanford Linear Accelerator Center, Calif.
FRACTIONAL CHARGE IN A NUT-SHELL
D. Boyanovsky and R. Blankenbecler Apr. 1985 4 p Presented at the Symposium on Anomalies, Geometry and Topology, Argonne, Ill., 28 Mar. 1985
(Contract DE-AC03-76SF-00515)
(DE85-013053; SU-SLAC-PUB-3652; CONF-8503141-1) Avail: NTIS HC A02/MF A01

We study the physics of charge fractionalization using simple methods. The strategy is to count the number of states of the theory with solitons relative to the same theory with trivial background fields. The interplay between high and low energy contributions is exposed and the topological properties clarified. DOE

N86-17170# Sandia National Labs., Albuquerque, N. Mex.
IMPORTANT CONCEPTS IN THE ASSEMBLY AND EARLY CHARACTERIZATION OF THE PBFA 2 ACCELERATOR
S. A. Goldstein, R. J. Clevenger, G. L. Donovan, G. T. Holman, R. R. Johnston, and D. R. Nations 1985 23 p Presented at the 5th IEEE Pulsed Power Conference, Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-012864; SAND-84-2170C; CONF-850616-19) Avail: NTIS HC A02/MF A01

Some of the concepts for orchestrating large numbers of events associated with accelerator assembly and characterization include: (1) structuring of activity into smaller workable and trackable packages, with associated subelements assigned to each section of the accelerator, (2) establishing detailed assembly and characterization documentation to assist in component testing and subsystem integration, (3) structuring the project team for efficient communication, identification of responsibility, and capability for problem and conflict resolution, and (4) developing technologies for receival, inventory, controlled storage, staging, and phased installation and testing of components and pieceparts. The application of these and other concepts to PBFA II, and the progress of accelerator assembly is discussed. DOE

N86-17171# Oak Ridge National Lab., Tenn.
SUBMILLIMETER WAVE PROPAGATION IN TOKAMAK PLASMAS
C. H. Ma, D. P. Hutchinson, P. A. Staats, K. L. VanderSluis, D. K. Mansfield, H. Park, and L. C. Johnson 1985 7 p Presented at the International Symposium on Antennas and EM Theory, Beijing, China, 25 Aug. 1985 Prepared in cooperation with Princeton Univ., N.J.
(Contract DE-AC05-84OR-21400)
(DE85-016292; CONF-8508113-1) Avail: NTIS HC A02/MF A01

The propagation of submillimeter-waves (smm) in tokamak plasmas has been investigated both theoretically and experimentally to ensure successful measurements of electron density and plasma current distributions in tokamak devices. Theoretical analyses have been carried out to study the polarization of the smm waves in TFTR and ISX-B tokamaks. A multichord smm wave interferometer/polarimeter system has been employed to simultaneously measure the line electron density and poloidal field-induced Faraday rotation in the ISX-B tokamak. The experimental study on TFTR is under way. Computer codes have been developed and have been used to study the wave propagation and to reconstruct the distributions of plasma current and density from the measured data. The results are compared with other measurements. DOE

N86-17172# Lawrence Livermore National Lab., Calif.
SUMMARY OF TMX-U RESULTS: 1984. VOLUME 2
T. C. Simonen, ed. 14 Dec. 1984 506 p
(Contract W-7405-eng-48)
(DE85-017287; UCID-20274-Vol-2) Avail: NTIS HC A22/MF A01

The following areas are covered in this volume: (1) TREQ code; (2) Fokker-Planck and Monte Carlo calculations; (3) vacuum and gas modeling; (4) TMX-U data analysis and formulary; (5) thermal barrier operation; (6) plasma stability; (7) MHD and beta limits; (8) lf fluctuations; (9) central-cell ion-cyclotron microinstability; (10) end-cell ion-cyclotron microinstability; and (11) hot electron microinstability. In addition, discussions on the following technological developments are given: vacuum, magnet, fueling, heating, potential control technology, diagnostic systems, and computer systems. DOE

N86-17173# New York Univ., New York. Magneto-Fluid Dynamics Div.
SEMI-IMPLICIT METHOD FOR MHD COMPUTATIONS WITHOUT AN ALFVEN WAVE CFL RESTRICTION
D. S. Harned and D. D. Schnack May 1985 31 p
(Contract DE-AC02-76ER-03077)
(DE85-017374; DOE/ER-03077/247; MF-106) Avail: NTIS HC A03/MF A01

A semi-implicit method for solving the three-dimensional magnetohydrodynamic equations on long time scales is presented. Standard explicit methods must use time steps which are constrained by a Courant-Friedrichs-Lewy condition due to the fast compressional and shear Alfven motion. This semi-implicit method eliminates both of these restrictions so that very large time steps are permitted. The method is simple to implement and the computation time for one time step is essentially the same as for

explicit methods. Numerical test results in slab and cylindrical geometry are presented. DOE

N86-17174# Superwave Technology, Inc., Santa Clara, Calif.
DEMONSTRATION OF FEASIBILITY OF DEPOSITING SEMICONDUCTOR LAYERS USING MICROWAVE ENHANCED PLASMA TECHNIQUES Final Technical Report
1985 52 p
(Contracts NAS7-100; JPL-9-56828)
(NASA-CR-176458; DOE/JPL-956828-03; NAS 1.26:176458; DE85-011833) Avail: NTIS HC A04/MF A01

Manufacturing of low cost more efficient photovoltaic cells partly depends on the development of new process technologies, one of which is the deposition of thin films at relatively low substrate temperatures. Superwave Technology, in an effort to demonstrate the feasibility of microwave enhanced plasma as a means of producing better quality films, has successfully developed a simple but versatile system. The microwave enhanced plasma system developed has the capability of depositing various films of different compositions. This effort was directed towards deposition of silicon nitride film through gas phase plasma reaction. DOE

N86-17175# Lawrence Livermore National Lab., Calif.
COLLISION BROADENED RESONANCE LOCALIZATION IN TOKAMAKS EXCITED WITH ICRF WAVES
G. D. Kerbel and M. G. McCoy Aug. 1985 23 p Presented at the 3rd European Workshop on Problems in the Numerical Modeling of Plasmas, Varenna, Italy, 10 Sep. 1985
(Contract W-7405-eng-48)
(DE85-017829; UCRL-92608; CONF-8509162-1) Avail: NTIS HC A02/MF A01

Advanced wave models used to evaluate ICRH in tokamaks typically use warm plasma theory and allow inhomogeneity in one dimension. The authors have developed a bounce-averaged Fokker-Planck quasilinear computational model which evolves the population of particles on more realistic orbits. Each wave-particle resonance has its own specific interaction amplitude within any given volume element. These data need only be generated once, and appropriately stored for efficient retrieval. The wave-particle resonant interaction then serves as a mechanism by which the diffusion of particle populations can proceed among neighboring orbits. Collisions affect the absorption of RF energy by two quite distinct processes: In addition to the usual relaxation towards the Maxwellian distribution creating velocity gradients which drive quasilinear diffusion, collisions also affect the wave-particle resonance through the mechanism of gyro-phase diffusion. The local specific spectral energy absorption rate is directly calculable once the orbit geometry and populations are determined. The code is constructed in such fashion as to accommodate wave propagation models which provide the wave spectral energy density on a poloidal cross-section. Information provided by the calculation includes the local absorption properties of the medium which can then be exploited to evolve the wave field. DOE

N86-17176# Department of Energy, Washington, D. C.
STEADY-STATE INDUCTIVE SPHEROMAK OPERATION Patent Application
A. C. Janos (Princeton Univ., N.J.), S. C. Jardin, and M. Yamada, inventors (to DOE) Filed 20 Feb. 1985 37 p
(Contract DE-AC02-76CH-03073)
(DE85-017759; US-Patent-Appl-SN-703577) Avail: NTIS HC A03/MF A01

The inductively formed spheromak configuration (S-1) can be maintained in a highly stable and controlled fashion. The method described eliminates the restriction to pulsed spheromak plasmas or the use of electrodes for steady-state operation, and, therefore, is a reactor-relevant formation and sustainment method. DOE

N86-17177# Department of Energy, Washington, D. C.
TOKAMAK REACTOR FIRST WALL Patent Application
R. L. Creedon (GA Technologies, Inc., San Diego, Calif.), H. E. Levine, C. Wong, and J. Battaglia, inventors (to DOE) Filed 20 Nov. 1984 17 p
(Contract DE-AT03-76ET-51011)
(DE85-017771; US-Patent-Appl-SN-673450) Avail: NTIS HC A02/MF A01

A first wall construction for a tokamak reactor is disclosed. The wall comprises a series of hollow lobes, each with a pair of side wall portions with a curved end wall portion which extends between it. This invention relates to an improved first wall construction for a tokamak fusion reactor vessel, or other vessels subjected to similar pressure and thermal stresses. DOE

N86-17178# Kema (N. V.), Arnhem (Netherlands). Dept. of Physical Research.
ION DENSITY AND DIELECTRIC BREAKDOWN IN THE AFTERGLOW OF A HIGH-CURRENT ARC DISCHARGE
W. R. Rutgers, F. C. M. Verhagen, W. A. deZeeuw, and A. J. vanLoon, ed. 1984 16 p refs
(S/T-Rept-Vol-2-No-9; ISBN-90-353-0020-3; ISSN-0167-8590; B8569666) Avail: NTIS HC A02/MF A01

The ion density in the afterglow of a high-current atmospheric arc-discharge and electrical breakdown were investigated in atomic (argon), molecular (nitrogen) and electronegative (carbon dioxide) media. From the decay with time of the ion density, effective recombination coefficients can be calculated. When the ion density is reduced to values < 2 times 10 to the 17th power/cum the afterglow plasma changes from a resistive into a dielectric medium. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-17179 Michigan State Univ., East Lansing.
THEORY OF THE ELASTIC AND VIBRATIONAL PROPERTIES OF CENTRAL FORCE RANDOM NETWORKS Ph.D. Thesis
Edward Joseph Garboczi 1985 160 p
Avail: Univ. Microfilms Order No. DA8513898

Central force random networks which are generated by randomly removing bonds on a lattice are simple models with which to study the rigidity transition where the elastic moduli of a system go to zero as a function of decreasing mean connectivity. A simple constraint counting argument gives a prediction for the critical threshold p*, called the rigidity threshold, and f(p), the fraction of zero frequency modes, where p is the fraction of bonds present evidence from three different networks is presented that shows these predictions to be in excellent agreement with numerical simulations. Also it is shown that the elastic moduli for nearest neighbor central forces scale linearly with p, in excellent agreement with a simple effective medium theory. This coherent potential approximation based effective medium theory also gives a quite good description of the entire vibrational density of states for these same networks. Evidence is presented from both numerical simulation and effective medium theory that a fixed point exists-- the ratio of C sub 11/C sub 44 always converges to a constant along a given track in phase space independent of its starting value before removing bonds. Dissert. Abstr.

N86-17180 Oklahoma State Univ., Stillwater.
LASER SPECTROSCOPIC STUDIES OF IONS IN SOLIDS Ph.D. Thesis
Ali Muhammed Ghazzawi 1984 114 p
Avail: Univ. Microfilms Order No. DA8515262

Time-resolved site-selection spectroscopy is utilized to study spectral energy migration between Eu sup 2 + ions in RbMgF3:Euk sup 2 +, Mn sup 2 + crystal. Degenerate four-wave mixing (FWM) transient-grating spectroscopy is employed to study certain nonlinear processes in alexandrite (BeAl2O4:Cr sup 3 +) crystal. Excition diffusion is investigated in NdP5O14 by nondegenerate FWM transient-grating spectroscopy. In RbMgF3:Eu sup 2 + crystal, the results indicate that the transfer process between Eu

sup 2 + ions in three nonequivalent sites is consistent with electric dipole-dipole interaction and is enhanced by the thermal occupation of the upper crystal field component of the sensitizer. The microscopic origin of the different types of sites may be due to the presence of structural or chemical impurities in the lattice. The results imply that Eu sup 2 + ions are forming clusters in this host. The FWM signal efficiency in alexandrite varies quadratically with pump power for large pump beam crossing angles with some saturation at small angles. Dissert. Abstr.

N86-17181 Arizona Univ., Tucson.
A SEARCH FOR CHANGES IN THE BAND STRUCTURE OF EXTREMELY STRAIN-FREE Mg(Cd) CRYSTALS AS A FUNCTION OF ALLOYING, IN THE DILUTE LIMIT Ph.D. Thesis
John Carlton Kupfer 1985 122 p
Avail: Univ. Microfilms Order No. DA8514912

A study of a specific doublet of de Haas-van Alphen frequencies in pure Mg and very dilute Mg(Cd) alloys with the magnetic field aligned with the c-axis. The work involved three stages. First, the use of extremely strain-free crystals, temperatures down to 40 millidegree Kelvin, large amplitude modulation, and the fast Fourier transform allowed the components of this doublet to be well resolved. This resolution allowed measurement of the changes in the cross sectional area as a function of magnetic field orientation to verify the assignment of this doublet to the cap and monster arm junction at the top of the Brillouin zone. Third, with the magnetic field aligned with the c-axis, the splitting of this doublet offered a direct and sensitive indication of any symmetry breaking changes in the (0001) Fourier component of the ionic lattice potential in Mg upon the introduction of Cd. C. B. Friedberg's analysis of his electron interference lineshape data from the quantum interferometer in Mg had indicated that the energy of this band gap should increase by 40% with the introduction of 15 ppm Cd.
Dissert. Abstr.

N86-17182 Texas A&M Univ., College Station.
THEORY OF INTERFACE STATES AT SI/TRANSITION. METAL-SILICIDE INTERFACES Ph.D. Thesis
Hunhwa Lim 1985 151 p
Avail: Univ. Microfilms Order No. DA8514252

The Si/NiSi2(111) interface is of both fundamental and technological interest: From the fundamental point of view, it is the best characterized of all semiconductor/metal interfaces, with two well-determined geometries (A and B) involving nearly perfect bonding. Consequently, a theoretical treatment of this system makes sense as it would not for messier systems-and one can have some confidence that the theoretical predictions are relevant to experimental observations. From the technological point of view, Si/NiSi2 is representative of the class of semiconductor/metal interfaces that are currently of greatest interest in regard to electronic devices, Si/transition-metal-silicide interfaces. The calculations of this dissertation are for the intrinsic interface states of Si/NiSi2-A geometry. These calculations also provide a foundation for later studies of defects at this interface, and for studies of other related systems, such as CoSi2. The calculations employ empirical tight-binding Hamiltonian for both Si and NiSi2 (with the parameters fitted to prior calculations of the bulk band structures, which appear to be in agreement with the available experimental data on bulk Si and NiSi2). Dissert. Abstr.

N86-17183 Iowa State Univ. of Science and Technology, Ames.
THEORY OF FLUX-LINE CUTTING AND THE CRITICAL STATE IN TYPE-2 SUPERCONDUCTING Ph.D. Thesis
Antonio Pepez-Gonzalez 1985 166 p
Avail: Univ. Microfilms Order No. DA8514429

This thesis is divided into four related sections, each one dealing with an aspect of the response of type-2 superconducting materials subjected to applied magnetic fields which change in magnitude and generation. A general critical-state theory, which includes both flux pinning and flux-line cutting, is presented. The electromagnetic response of a type-2 superconducting slab subjected to a parallel, constant magnetic field whose direction undergoes either continuous rotation or periodic oscillation is investigated. B, J, and Evectorfied distributions during the approach to quasi-steady state of a slab subjected to a parallel rotating magnetic field are calculated. It is shown that, regardless of the specimen's magnetic history, flux-line-cutting B-consumption leads to a final state in which B has a diamagnetic profile near the surface of the specimen. Hysteretic losses in samples subjected to an oscillating magnetic field oriented at an arbitrary angle with respect to a bias field, both fields being parallel to the surface, are discussed. Dissert. Abstr.

N86-17184 Northeastern Univ., Boston, Mass.
TRANSPORT AND ELECTRONIC PROPERTIES OF METALLIC GLASSES Ph.D. Thesis
Ab Do Khalil Ibrahim 1985 176 p
Avail: Univ. Microfilms Order No. DA8516447

Infra-red optical reflectivity measurements from 0.02 to 2.5 eV were made on amorphous Ni sub (1-x) P sub x (0.15 < x < 0.27) and La sub (1-x) Al (0.2 < x < 0.45). Fits of the reflectivity data were made to Drude model, and the fitting parameters omega and 1/tau were extracted. For La-Al show a minimum at 35 at.% Al, while in Ni-P they were monotonically decreasing with P concentration. The optical conductivities extracted from these parameters were in good agreement with the DC data. The optical data indicated that the scattering mechanism in these systems is controlled by the density of states at the Fermi level. Overall behavior of the density of states at the Fermi energy was suggestive of a rigid band picture. Galvanomagnetic effect measurements on amorphous Ni-P samples indicate that both the apparent Hall coefficient and the transverse magnetoresistance change signs near 23 at.% P. However, the classical Hall coefficient was always negative, as in ordinary crystalline Ni, indicating that the electrons are the main contributor to the conduction in this system. We attribute the change of sign of R sub 0 = to the spontaneous Hall coefficient, implying the presence of free moments throughout the P concentration range. An estimate of the magnitude of the side jump scattering in the Ni-P system was the same as those based on the free electron approximation. Dissert. Abstr.

N86-17185 Department of the Air Force, Washington, D.C.
SIMULTANEOUS DOPED LAYERS FOR SEMICONDUCTOR DEVICES Patent
F. Z. Hawrylo, inventor (to Air Force) Issued 11 Jun. 1985 4 p Supersedes AD-D009500
(AD-D011907; US-Patent-4,523,212; US-Patent-Appl-SN-357441; US-Patent-Class-357-17) Avail: US Patent and Trademark Office CSCL 20/12

An indium phosphide semiconductor layer or layers are simultaneously doped with groups 2-6 elements such as zinc and selenium. These simultaneously (acceptor/-donor) doped layers offer improved characteristics when used as an ohmic contact capping layer of indium phosphide or as the active laser region in long wavelength light emitting diodes composed of indium phosphide. The simultaneous doping is achieved through the use of liquid phase epitaxy. Author (GRA)

N86-17186# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MILESTONES IN CRYSTAL GROWTH, THE ACCELERATED CRUCIBLE ROTATION TECHNIQUE (ACRT)
Hans J. Scheel Jul. 1985 16 p refs Submitted for publication (INPE-3583-PRE/783) Avail: NTIS HC A02/MF A01

A personal account on the invention of the accelerated crucible rotation technique and its impact on crystal growth technology is presented. Author

N86-17187*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MECHANICAL TESTING OF LARGE THALLIUM DOPED SODIUM IODIDE SINGLE CRYSTALS
Henry M. Lee Sep. 1985 67 p refs
(NASA-TM-86518; NAS 1.15:86518) Avail: NTIS HC A04/MF A01 CSCL 20L

The findings of mechanical tests performed on five thallium-doped sodium iodide [NaI(Tl)] crystals are presented. These crystals are all in the shape of circular flat plates, 20.0 in. in diameter an d0.5 in. thick. The test setup, testing procedure, and the test data are presented. Large crystals exhibit a high degree of material plasticity, as well as a much higher strength than previously anticipated, on the order of 500 psi. Also revealed from the testing is the fact that crystal with a large number of grain boundaries developed less plasticity, and therefore less permanent deformation, than those with fewer grain boundaries. Author

N86-17188# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
COMPREHENSIVE APPROACH TO MELT GROWTH OF 3-5 COMPOUND SEMICONDUCTORS WITH SPECIAL CONSIDERATION OF InP, InSb AND GaAs Final Report, 1 Feb. 1981 - 30 Nov. 1983
A. F. Witt Jun. 1985 32 p
(Contract F19628-81-K-0017)
(AD-A157881; RADC-TR-85-68) Avail: NTIS HC A03/MF A01 CSCL 20/12

The thrust of this research program was aimed at improving the chemical and crystalline perfection achievable with Liquid encapsulation (LEC) growth in compound semiconductors with special consideration of InP. To permit isolation and identification of systems specific (InP, InSb, GaAs, GaSb, etc.) and process specific (liquid encapsulation, high pressure) phenomena and effects, extensive use of model systems (e.g., InSb) was made. The approach taken to the quantitative investigation of growth and segregation in InP was based on interference contrast analyses on differentially etched crystal specimens. On the basis of the present investigation it is concluded that the achievement of a high degree of chemical and crystalline perfection for LEC growth of compound semiconductors at elevated pressures is contingent on rigorous heat transfer (thermal gradient) control within the hot zone, melt stabilization, and effective solid solution hardening (with elements which will not adversely affect the electronic properties of the solid matrix. GRA

N86-17189# Fairchild Camera and Instrument Corp., Palo Alto, Calif.
HOLE TRAPPING IN THERMAL OXIDES GROWN UNDER VARIOUS OXIDATION CONDITIONS USING AVALANCHE INJECTION IN POLY-SILICON GATE STRUCTURES Final Technical Report, Jul. 1982 - Mar. 1985
K. V. Anand, B. R. Cairns, and R. J. Strain 15 Mar. 1985 64 p
(Contract N00014-82-C-0686; ARPA Order 3721)
(AD-A158703; FAIRCHLD/RC/TR-85/01) Avail: NTIS HC A04/MF A01 CSCL 09/5

I/v data (where I is the dc current and v is the maximum value of the ac applied voltage across the device) was analyzed with respect to the theory and it was shown that the hole temperature not only depends on the substrate doping density and the electric field as measured by the Delta V subscript FB is not only a characteristic of the way that an oxide is grown and annealed, but it also depends on the quality of the substrate and its detailed thermal history. This substrate effect shows itself in the I/v characteristic of a particular device. If the dc current Idc was kept constant at a particular level (as was the case for our experiments), then the v value would represent the temperature of the hot carriers. Since the evidence suggests that the hot carriers generate trap levels, then any change in carrier temperature would reflect in Delta V subscript FB. These substrate related effects were found to be significant. GRA

N86-17190# Oak Ridge National Lab., Tenn.
ION DAMAGE CALCULATIONS IN CRYSTALLINE SILICON
O. S. Oen Jul. 1985 15 p Presented at the 11th International Conference on Atomic Collisions in Solids, Washington, D.C., 4 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016931; CONF-850813-2) Avail: NTIS HC A02/MF A01

Damage profiles in crystalline silicon produced by light Band heavy Bi ions with energies from 10 to 100 keV were studied using the computer program MARLOWE (version 12). The program follows not only the incident ion collision by collision, but also any Si target atom that is set into motion through an energetic collision. Thus, the transport effect of the complete cascade of recoiled target atoms is included in the damage profile. The influence of channeling was studied for Si(100) using beam tilt angles from the surface normal of 0, 3, and 7 deg. about the [001] or [011 axes. The effects of channeling on the damage profile are twofold: first, there is a large reduction of the central damage peak; second, there is a component of the damage profile that extends considerably deeper into the target than that found in conventional studies using a random target assemblage. The influence of amorphous overlayers of SiO2 on the damage and implantation profiles in the Si(100) substrate has also been investigated. DOE

N86-17191# Arizona Univ., Tucson.
ARTIFICIALLY LAYERED SUPERCONDUCTORS Progress Report
C. M. Falco 28 Nov. 1984 20 p
(Contract DE-AC02-83ER-45025)
(DE85-014443; DOE/ER-45025/6) Avail: NTIS HC A02/MF A01

The preparation and structure of artificial metallic multilayers and the superconducting properties of weak links in these materials are being studied. Materials being used are Ta/Mo and Nb/Mo. DOE

N86-17192# Litton Industries, Morris Plains, N.J. Airtron Div.
RESEARCH IN GARNET CRYSTAL (GSGG) DEVELOPMENT Final Report, 1 May 1984 - 31 Dec. 1984
R. F. Belt, R. Uhrin, and K. Vemuri Jan. 1985 95 p
(Contract DE-AC08-84DP-40198)
(DE85-016125; DOE/DP-40198/1) Avail: NTIS HC A05/MF A01

This program describes the crystal growth of neodymium and chromium doped simultaneously into the host crystal of gadolinium scandium gallium garnet (Nd(3+), Cr(3)+:Gd3(Sc,Ga)2 Ga3O12 or Nd,Cr:GSGG). Ten experimental boules were grown by the Czochralski method at a diameter of 1.0 to 1.2 inch. Special attention was given to congruently melting compositions, the Nd and Cr content, growth rate, atmosphere of growth, control of the solid liquid interface, and boule orientation. For each of our crystals a (0.25 x 3.00) inch cylindrical laser rod was extracted, fabricated, tested passively, and delivered to the Lawrence Livermore National Laboratory for active testing. At the same time, boule samples were examined for optical absorption, loss at 1.06(MU)m, refractive index birefringence, and other physical properties. Results have demonstrated that optical quality can approach that of Nd:YAG in rod form. The increased efficiency of Nd,Cr:GSGG was confirmed to be about 2 times that of Nd:YAG. We also show that 2 inch diameter crystal boules can be grown successfully. It appears that larger boules are feasible for slab laser experiments. DOE

N86-17193# Sandia National Labs., Albuquerque, N. Mex.
AUGER ELECTRON SPECTROSCOPY STUDIES OF BORON CARBIDE
H. H. Madden, G. C. Nelson, and W. O. Wallace 1985 11 p Presented at the International Conference on the Physics and Chemistry of Boron and Boron-Rich Borides, Albuquerque, N. Mex., 29 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-017428; SAND-85-1687C; CONF-850786-2) Avail: NTIS HC A02/MF A01

Auger electron spectroscopy has been used to probe the electronic structure of ion bombardment (IB) cleaned surfaces of B9C and B4C samples. The shapes of the B-KVV and C-KVV Auger lines were found to be relatively insensitive to the bulk stoichiometry of the samples. This indicates that the local chemical environments surrounding B and C atoms, respectively, on the surfaces of the IB cleaned samples do not change appreciably in going from B9C to B4C. Fracturing the sample in situ is a way of producing a clean representative internal surface to compare with the IB surfaces. Microbeam techniques have been used to study a fracture surface of the B9C material with greater spatial resolution

than in our studies of IB surfaces. The B9C fracture surface was not homogeneous and contained both C-rich and B-rich regions. The C-KVV line for the C-rich regions was graphitic in shape. Much of the C-rich regions was found by IB to be less than 100 nm in thickness. The C-KVV line from the B-rich regions was carbidic and did not differ appreciably in shape from those recorded for the IB cleaned surfaces. DOE

N86-17194# Los Alamos National Lab., N. Mex.
COMMENTS CONCERNING THE CRYSTAL STRUCTURE OF B4C
A. C. Larson 1985 6 p refs Presented at the International Conference on the Physics and Chemistry of Boron and Boron-Rich Borides, Albuquerque, N. Mex., 29 Jul. 1985
(Contract W-7405-eng-36)
(DE85-017566; LA-UR-85-2833; CONF-850786-3) Avail: NTIS HC A02/MF A01

The crystal structure of B4C at approx.20 atom% carbon is reported. The space group is R 3m, hexagonal cell lattice constants are a=5.6039(4)A, c=12.0786(14)A, v=109.50A sup 3, Z=3, MU(MoKalpha)=0.05 mm(-1). The excess carbon above the stoichiometric composition of B13C2 replaces up to 1/6 of the boron in the rhombohedral boron site (B2). The results this refinement are reported and compared with earlier results reported on lower carbon samples. Evidence is that the icosahedron is essentially pure boron at and below carbon compositions of 13.3 a%. DOE

N86-17195# California Inst. of Tech., Pasadena. Lab. of Engineering Materials.
KINETICS OF GROWTH OF AN AMORPHOUS PHASE IN CRYSTALLINE ZIRCONIUM RHODIUM ALLOYS DURING REACTION WITH HYDROGEN
X. Yeh, I. and W. L. Johnson Aug. 1985 22 p
(Contract DE-AS03-81ER-10870)
(DE85-018061; DOE/ER-10870/157) Avail: NTIS HC A02/MF A01

The kinetics of amorphous phase formation during reaction of polycrystalline Zr/sub 75(+x)Rh sub 25-(x) ($0 < x < 10$ with hydrogen has been studied by X-ray diffraction, TEM and electron diffraction. The TEM micrographs show that amorphous phase grows at grain boundaries of polycrystalline Zr/sub 75+x/Rh/sub 25-x/. X-ray diffraction patterns vs reaction time shows that this growth has an Avrami index of one. The growth mechanism is discussed in terms of thermodynamics. DOE

N86-17196# Oak Ridge National Lab., Tenn.
NUMERICAL SIMULATION OF A HgCdTe SOLIDIFICATION PROCESS
V. Alexiades, G. A. Geist, and A. D. Solomon Aug. 1985 35 p
(Contract DE-AC05-84OR-21400)
(DE85-018089; ORNL-6127) Avail: NTIS HC A03/MF A01

The solidification of a cylindrical ingot of mercury-cadmium-telluride is modeled taking into account both heat conduction and solute diffusion. Values of the relevant thermophysical parameters of the pseudo-binary HgTe-CdTe are compiled. The model is implemented numerically by a finite-difference discretization and results of the simulation of a freezing experiment are reported. DOE

N86-17197# Brookhaven National Lab., Upton, N. Y.
SUPERCOMPUTERS AND QUANTUM FIELD THEORY
M. Creutz 1985 13 p refs Presented at the Kyoto International Symposium: The Jubilee of the Meson Theory, Kyoto, Japan, 15 Aug. 1985
(Contract DE-AC02-76CH-00016)
(DE85-017844; BNL-36876; CONF-8508120-1) Avail: NTIS HC A02/MF A01

A review is given of why recent simulations of lattice gauge theories have resulted in substantial demands from particle theorists for supercomputer time. These calculations have yielded first principle results on non-perturbative aspects of the strong interactions. An algorithm for simulating dynamical quark fields is discussed. DOE

N86-17198# Lawrence Livermore National Lab., Calif.
NEUTRON IRRADIATION OF SUPERCONDUCTORS AND DAMAGE ENERGY SCALING OF DIFFERENT NEUTRON SPECTRA
P. A. Hahn, H. W. Weber, M. W. Guinan, R. C. Birtcher, B. S. Brown, and L. R. Greenwood Aug. 1985 9 p refs Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985 Prepared in cooperation with Argonne National Lab., Ill. and Technische Univ., Vienna, Austria
(Contract W-7405-eng-48)
(DE85-017834; UCRL-93186; CONF-850814-6) Avail: NTIS HC A02/MF A01

Three different neutron sources were used to irradiate identical sets of NbTi superconductors up to about half the lifetime dose of a superconducting magnet in a fusion reactor. Based on a careful source characterization of the TRIGA Mark-II reactor in Vienna, the spallation neutron source IPNS at Argonne and the 14 MeV neutron source RTNS-II at Livermore, the damage energy cross sections were calculated for four different types of NbTi alloys (42, 46.5, 49 and 54 wt % Ti). The experimental results on the variations of critical current densities j sub c with neutron dose are found to scale within the experimental uncertainties with the appropriate damage energy cross sections. This first explicit proof of damage energy scaling for j sub c-variations in superconductors is considered to be most valuable for the evaluation of radiation damage in superconductors under fusion reactor conditions. DOE

N86-17199# Oak Ridge National Lab., Tenn.
REFLECTANCE OF Co- AND Nb-DOPED BaTiO3 FOR PHOTON ENERGIES FROM 1.8 TO 70 eV
J. P. Goudonnet, G. Godefroy, T. Inagaki, P. Moretti, M. W. Williams, and E. T. Arakawa 1985 14 p refs Presented at the 6th International Meeting on Ferroelectricity, Kobe, Japan, 12 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-018070; CONF-850880-3) Avail: NTIS HC A02/MF A01

The reflectance spectra of Co and Nb-doped BaTiO3 crystals have been measured for photon energies from 1.8 to 70 eV. For both types of crystal, structures observed in the 1.8 to 2.3 eV range can be attributed to the presence of residual impurities. Between 2.3 and 3.2 eV the peaks in the reflectance of the Co-doped crystal are found to be of an acceptor charge transfer type. For Nb-doped crystals structures appear at the bottom of the conduction band. For energies larger than 3.2 eV the spectra are characteristic of pure BaTiO3 crystals, in reasonable agreement with those determined by Baeuerle, et al., and calculated by Michel-Calendini and Moretti. DOE

N86-17200# Argonne National Lab., Ill.
CRYSTAL-FIELD SPECTROSCOPY OF UCl4 BY NEUTRON INELASTIC SCATTERING
P. Delamoye, J. C. Krupa, S. Kern, C. K. Loong, and G. H. Lander 1985 11 p refs Presented at the ACTINIDES '85, Aix-en-Provence, France, 1 Sep. 1985 Prepared in cooperation with Paris XI Univ., Orsay, France and Colorado State Univ., Fort Collins
(Contract W-31-109-eng-38)
(DE85-018403; CONF-8509147-7) Avail: NTIS HC A02/MF A01

The crystal-field level scheme of uranium tetrachloride has been the subject of a number of investigations by both optical and magnetic measurements. Agreement does not exist. To attempt to resolve this problem we have performed experiments with the pulsed neutron source at ANL which allows electronic spectroscopy to be extended to approx. 2000/cm(-1). Initially using incident energies of 400/cm we examined the gamma4 (ground state) to gamma5 (excited state) level with the sample at 10K. A very strong line is seen at 92 + or - 1/cm which is clearly the gamma4 (yields) gamma5' transition. This is in good agreement with a previous neutron study but in disagreement with the 110 to 120/cm

assignment by other techniques. On warming to 50K the peak position shifts to lower energy by approx. 4%, broadens, and decreases dramatically in magnitude to approx. 1/3 of its value at 10K. Boltzmann statistics would predict a decrease of only 20% on warming from 10 to 50K. We assume from this that a strong coupling occurs between the crystal-field and vibronic states. We have also used an incident energy of 2000/cm to search for the higher gamma5' state. This was found at 1125 + or - 3/cm, in good agreement with previous work. On warming the sample this gamma4 (yields) gamma5 transition strength rapidly diminishes. Since the phonon spectrum does not extend beyond approx. 300/cm, this behavior is most unusual. Because of this strong relaxational process, we have not been able to determine the positions of the other crystal-field levels. DOE

N86-17201# Illinois Univ., Urbana. Dept. of Physics.
NEUTRON SCATTERING INVESTIGATION OF MAGNETIC PHASE TRANSITIONS IN CoCl2-GRAPHITE INTERCALATION COMPOUNDS
D. G. Wiesler, M. Suzuki, H. Zabel, S. M. Shapiro, and R. M. Nicklow Aug. 1985 8 p refs Presented at the International Conference on Magnetism, San Francisco, Calif., 26 Aug. 1985 Prepared in cooperation with Brookhaven National Lab., Upton, N.Y. and Oak Ridge National Lab., Tenn.
(Contract DE-AC02-76CH-00016)
(DE86-000022; BNL-36928; CONF-850890-18) Avail: NTIS HC A02/MF A01

The stage 2 CoCl2-graphite intercalation compound exhibits two magnetic phase transitions at T sub Cl (=8.0K) and T sub Cu (=9.1K). We have performed neutron scattering experiments on this compound which revealed at T < T sub Cl a spin structure in which the 2D ferromagnetic CoCl2-sheets are stacked antiferromagnetically along the c-axis with weak 3D correlation. The intermediate phase between T sub Cl and T sub Cu is purely 2D in character with ferromagnetic in-plane order. DOE

N86-17202# Brookhaven National Lab., Upton, N. Y.
INTERNAL-TIN-PROCESSED NB3Sn MULTIFILAMENTARY WIRES ALLOYED WITH Mg Zn + Ni, AND TI THROUGH THE Sn CORE
T. Kuroda, M. Suenaga, C. J. Klamut, and R. Sabatini 1985 9 p refs Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985
(Contract DE-AC02-76CH-00016)
(DE86-000029; BNL-36944; CONF-850814-18) Avail: NTIS HC A02/MF A01

The influence on superconducting properties by alloying Nb3Sn with an alloyed Sn core in internal-tin-processed multifilamentary Nb3Sn wires was investigated for alloying elements, Mg, Ni + Zn, and Ti. The results indicate that the critical current densities, J sub c of the Mg, Ni, and Ni + Zn-alloyed wires were essentially identical to or less than those for the unalloyed control wires although small amounts of Mg, Ni and Zn were found in the Nb3Sn filaments. However, additions of Ti increased the J sub c of the wire considerably at intermediate as well as very high-magnetic fields. Results of detailed characterization of these wires for superconducting and metallurgical properties are reported. DOE

N86-17203# Sandia National Labs., Albuquerque, N. Mex.
HIGH PRESSURE RESEARCH: AN OVERVIEW AND RECENT PROGRESS
G. A. Samara 1985 51 p refs Presented at the 10th High Pressure Conference on Research in High Pressure Science and Technology, Amsterdam, Netherlands, 8 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE86-000207; SAND-85-1747C; CONF-850759-14) Avail: NTIS HC A04/MF A01

A brief overview of high pressure science is presented. It is emphasized that the field is in the midst of a most exciting period brought about by (1) advances in apparatus and pressure range, (2) the availability of sophisticated microscopic probes, and (3) advances in theory and the coupling of theory and experiments. Examples of recent work in three areas are presented. These areas are (1) 3 to 5 strained-layer superlattices, (2) soft mode systems with dilute dipolar impurities, and (3) shock-induced chemical reactions. DOE

N86-17204# Sandia National Labs., Albuquerque, N. Mex.
CHEMICAL EFFECTS IN MATERIALS STUDIES USING AUGER ANALYSIS
R. R. Rye 1985 6 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract DE-AC04-76DP-00789)
(DE86-000436; SAND-85-2092C; CONF-851174-5) Avail: NTIS HC A02/MF A01

Core-valence-valence Auger spectra (AES) afford a unique local view of valence electron structure. The direct involvement in the Auger process of both core and valence states means that the transition matrix element will have a large value only for that portion of the valence electron density which covers the same spatial extent as the core wave function. Thus, the information content of AES is local to the atomic site containing the initial core hole. Our approach in understanding the local information content of AES has been mainly experimental through the intercomparison of model systems, both molecular and solid. The use of molecules in this regard is particularly useful since the vast array of molecular species of known geometric and electronic structures allows one to both vary these properties in a systematic fashion to observe trends and to choose a molecule to probe a specific chemical question. DOE

N86-17205# Fermi National Accelerator Lab., Batavia, Ill. Materials Science Center.
ANNOTATED BIBLIOGRAPHY OF ELLIPSOMETRY AND OPTICAL PROPERTIES OF SOLIDS
T. M. Christensen May 1985 23 p
(Contract DE-AC02-79ER-10501)
(DE86-000586; DOE/ER-10501/T2) Avail: NTIS HC A02/MF A01

This bibliography is a partial listing of articles on various aspects of ellipsometry and the optical properties of solids. Additional references can be found in the review articles listed in the first section. The comments about the articles represent the author's particular interest in the article and are by no means intended as complete summaries or even statements of the author's key point in the article. The lack of comments on many of the articles represents the author's inconsistent note-taking or the completeness of the author's title in describing the article. The papers are divided into 10 topical sections and are alphabetized within each section. DOE

N86-17206# Brookhaven National Lab., Upton, N. Y.
SCALING RELATIONS IN DOMAIN GROWTH: NON-DIFFUSIVE 1ST ORDER TRANSFORMATIONS
J. D. Axe 1985 20 p refs
(Contract DE-AC02-76CH-00016)
(DE86-000631; BNL-37047) Avail: NTIS HC A02/MF A01

We review some elementary concepts and recent progress in the understanding of first order phase transformation kinetics in systems with nonconserved order parameters. Special emphasis is given to scaling relations for domain growth in both nucleation and growth and in later coarsening stages. DOE

N86-17207# Research Inst. of National Defence, Linkoeping (Sweden).
ADVANCES IN HIGH FREQUENCY APPLICATIONS OF SUPERCONDUCTING TUNNEL JUNCTIONS
Staffan Rudner and Tord Claeson (Chalmers Univ. of Technology) Jul. 1985 31 p refs
(FOA-C-30400-E; ISSN-0347-3708) Avail: NTIS HC A03/MF A01; Research Inst. of National Defence, Stockholm KR 50

The development of superconducting junction microwave components since 1980 is reviewed. Quantum noise limited

superconducting microwave devices such as the quasiparticle SIS mixer and the Josephson parametric amplifier are described.
Author (ESA)

N86-17208# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
CAPTURE CROSS-SECTIONS OF STRUCTURAL MATERIALS MEASURED WITH THE HARWELL LARGE LIQUID SCINTILLATOR
D. B. Gayther, B. Thom, M. C. Moxon, and J. E. Jolly Jan. 1985 17 p
(AERE-R-11583) Avail: NTIS HC A02/MF A01

A preliminary analysis of these measurements has been published in the Proceedings of the Specialist's Meeting on Neutron Data of Structural Materials for Fast Reactors (Pergamen Press, 1979). Since then the results have been subject to considerable revision, and additional measurements have been included in the analysis. Improvements have also been made in the determination of the detector efficiency for capture gamma-rays and its sensitivity to scattered neutrons. Final values for the parameters of the principal resonances observed in natural iron in the energy range 200 eV to 40 keV are presented. Author

N86-16435# Joint Publications Research Service, Arlington, Va.
SILICON SEMICONDUCTOR DEVELOPMENTS
Andrzej Bukowski *In its* East Europe Report: Science and Technology (JPRS-ESA-85-036) 2 Dec. 1985 p 38-39 Repr. from Polish Technical Review (Warsaw, Poland), no. 2-3, 1985 p 3-4 (For primary document see N86-16432 07-31)
Avail: NTIS HC A04/MF A01

N86-16443# University of Electro-Communications, Tokyo (Japan).
LAMP ANNEALING OF ION IMPLANTED GaAs
Haruzo Miyashita and Kotaro Okamoto *In its* Reports of the University of Electro-Communications, Volume 36, No. 1, September 1985 (Serial No. 58) Sep. 1985 p 15-21 refs In JAPANESE; ENGLISH summary (For primary document see N86-16440 07-32)
Avail: NTIS HC A10/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N86-17209 Ruhr Univ., Bochum (West Germany). Inst. fuer Mechanik.
THERMODIFFUSION FLOWS IN A SOLID WITH A DOMINANT CONSTITUENT
Jan Kubik Apr. 1985 59 p refs
(RUB-IFM-MITT-44) Copyright. Avail: Issuing Activity

Thermodiffusion flows in mixtures of (n) constituents, assuming that every part of the solid is occupied by particles of all constituents simultaneously are considered. By analyzing the balance equations, the limiting process from mixture theory to thermodiffusion is obtained. This is only possible given the existence of a mixture constituent with a dominant density. The field equations of the thermomechanics concerning thermodiffusion in solids are based on the balance equations relating to mass, impulse, energy and entropy. As special cases of the theory, entropic diffusion, kinematic diffusion, filtration in solids, and classical thermodiffusion in solids are obtained. Author (ESA)

N86-17210*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY STUDY OF GASEOUS NITROGEN-LIQUID OXYGEN MIXING AND SELF CLEANING
Allan J. Zuckerwar Dec. 1985 12 p
(NASA-TM-87658; NAS 1.15:87658) Avail: NTIS HC A02/MF A01 CSCL 20M

The penetration of gaseous nitrogen into liquid oxygen at a pressure of 150 psi was determined by monitoring the composition of the evaporating liquid in a nitrogen analyzer. For pressurization times of about 1 hr the penetration depth varies between 0.0024 and 0.018 in. at an evaporation rate of about 1 gal/day. These are small compared to the penetration depth of 22.2 in. measured in the 7-inch high temperature tunnel at a pressure of 1500 psi, pressurization time of 5 min, and evaporation rate of 121 gal/day.
Author

N86-17211# Lawrence Livermore National Lab., Calif.
DESTRUCTION OF THE FRACTIONAL QUANTUM HALL EFFECT BY DISORDER
R. B. Laughlin Jul. 1985 14 p refs Presented at the Yamada Conference on Electronic Properties of Two-dimensional Systems, Kyoto, Japan, 9 Sep. 1985
(Contract W-7405-eng-48)
(DE85-016948; UCRL-93152; CONF-8509143-1) Avail: NTIS HC A02/MF A01

It is suggested that Hall steps in the fractional quantum Hall effect are physically similar to those in the ordinary quantum Hall effect. This proposition leads to a simple scaling diagram containing a new type of fixed point, which is identified with the destruction of the fractional states by disorder. DOE

N86-17212# Massachusetts Inst. of Tech., Cambridge.
CHERN-SIMONS TERMS AND COCYCLES IN PHYSICS AND MATHEMATICS
R. Jackiw Dec. 1984 22 p refs Presented at the APS Particles and Fields Meeting, Sante Fe, N. Mex., 1 Nov. 1984
(Contract DE-AC02-76ER-03069)
(DE86-000567; CONF-8411203-1) Avail: NTIS HC A02/MF A01

Contemporary topological research in Yang-Mills theory is reviewed, emphasizing the Chern-Simons terms and their relatives. Three applications of the Chern-Simons terms in physical theory are described: (1) to help understanding gauge theories in even dimensional space-time; (2) gauge field dynamics in odd dimensional space-time; and (3) mathematically coherent description of even-dimensional gauge theories with chiral fermions that are apparently inconsistent due to chiral anomalies. Discussion of these applications is preceded by explanation of the mathematical preliminaries and examples in simple quantum mechanical settings. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N86-17213*# Tresp Associates, Inc., Silver Spring, Md.
THE 1985 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S SUMMER HIGH SCHOOL APPRENTICESHIP RESEARCH PROGRAM (SHARP) Final Report
29 Nov. 1985 65 p
(Contract NASw-4037)
(NASA-CR-176472; NAS 1.26:176472) Avail: NTIS HC A04/MF A01 CSCL 05I

In 1985, a total of 126 talented high school students gained first hand knowledge about science and engineering careers by working directly with a NASA scientist or engineer during the summer. This marked the sixth year of operation for NASA's Summer High School Apprenticeship Research Program (SHARP). The major priority of maintaining the high standards and success of prior years was satisfied. The following eight sites participated in the Program: Ames Research Center, Ames' Dryden Flight Research Facility, Goddard Space Flight Center, Goddard's Wallop Flight Facility, Kennedy Space Center, Langley Research Center, Lewis Research Center, and Marshall Space Flight Center. Tresp Associates served as the SHARP contractor and worked closely with NASA staff at headquarters and the sites just mentioned to plan, implement, and evaluate the program. Author

N86-17214# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
NEW DIRECTIONS IN TRAINING SIMULATION RESEARCH: GENERATING, HANDLING AND DELIVERING EMPIRICALLY BASED DECISION SUPPORT
M. J. Singer and R. T. Hays Jan. 1985 34 p
(DA Proj. 2Q2-63744-A-795)
(AD-A156797; AIR-RR-1389) Avail: NTIS HC A03/MF A01 CSCL 05/9

An overview is given of recently completed, ongoing, and planned research designed to provide empirically based decision support for training device and training system design. New empirical data on training device design and use, and handling data and delivering empirically based decision support are discussed. Author (GRA)

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-17215 Case Western Reserve Univ., Cleveland, Ohio.
AN INVESTIGATION OF AUTOMATIC TERM WEIGHTING TECHNIQUES Ph.D. Thesis
Hyun-Hee Kim 1985 194 p
Avail: Univ. Microfilms Order No. DA8510124

The first objective is to devise a new term weighting technique which can be used to weight the significance value of each word stem in a test collection of documents on the subject of enteral hyperalimentation. The next objective is to evaluate retrieval performance of the proposed term weighting technique, together with four other weighting techniques, by conducting a set of experiments. These four term weighting techniques are the following: (1) Salton's term discrimination weighting technique; (2) Sparck Jones's inverse document frequency weighting technique; (3) Harter's compound poisson weighting technique using the method of moments; and (4) a modified Harter's compound poisson weighting technique utilizing the method of maximum likelihood. Dissert. Abstr.

N86-17216# Martin Marietta Energy Systems, Inc., Oak Ridge, Tenn.
LIBRARIAN-RESEARCHER COOPERATION WITH A LIAISON PROGRAM
A. E. Ekkebus 1985 4 p Presented at the 76th Ann. Special Libraries Assoc. Conference, Winnipeg, Manitoba, 8 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016409; CONF-8506127-2) Avail: NTIS HC A02/MF A01

During the four years of the liaison program, changes that have resulted include an increase in levels of library activity especially literature searching (a 60% increase in three years), a willingness by researchers to make their information needs known, and the development of a responsive collection. Surveys of recipients of the literature searches have indicated high satisfaction of the search results. The liaison program encourages communication between the reference librarian and researcher and better enables the library to attain its objective of interpreting and meeting the information needs of its users. DOE

N86-17217# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Computer Science Research.
CHARACTERISTICS OF SCIENTIFIC DATABASES
Arie Shoshani, Frank Olken, and Harry K. T. Wong Aug. 1985 16 p Previously announced as N85-74814
(Contract DE-AC03-76SF-00098)
(DE85-010983; LBL-17582-Rev) Avail: NTIS HC A02/MF A01

The kinds of data and usage of scientific databases are examined and common characteristics among the different discplines identified. Most scientific databases do not use general purpose database management systems (DBMS,). The main reason is that they have data structures and usage patterns that cannot be easily accomodated by existing DBMs. The special database management needs of scientific databases are identified, and to directions pointed out for further research specifically oriented to these needs. The different types of scientific databases are discussed, and the properties identified for them existed. Examples applications are then analyzed with respect to the types of data and their characteristics, and summarized in two tables. Conclusions are drawn as to the preferable data management methods needed in support of scientific databases. Author

N86-17218# Sandia National Labs., Albuquerque, N. Mex.
PRODUCT DATA EXCHANGE STANDARD (PDES)
J. C. Kelly 1985 77 p Presented at the Federal Computer Conference, Washington, D.C., 9 Sep. 1985
(Contract DE-AC04-76DP-00789)
(DE85-017637; SAND-85-1248C; CONF-8509155-1) Avail: NTIS HC A05/MF A01

PDES stands for Product Data Exchange Standard. A long-term project, chaired by Kalman Brauner of The Boeing Company, currently exists within the IGES Committee to develop PDES. This project has two primary objectives: (1) to develop an exchange standard for product data in support of industrial automation, and (2) to represent the US position in the International Standards Organization (ISO) arena relative to the development of a single worldwide standard for the exchange of product data. A new standard is being developed out of the belief that no existing standard can be extended to support industrial automation sufficiently well. Product Data is taken to be more general than product definition data. It includes data relevant to the entire life cycle of a product; manufacturing, quality assurance, testing, support, etc. Industrial product areas supported in previous exchange standards work within the IGES Committee includes mechanical, electrical, plant design, and AEC. While there is no inherent limitation in the PDES scope to these areas, it is naturally to be expected that these areas will be among the first to be addressed within PDES. Development of an exchange standard for product data involves settling on a set of logical structures to contain the product data information, and also settling on the manner in which these structures will be implemented in computer form. DOE

N86-17219# Allied Bendix Corp., Kansas City, Mo.
LABORATORY TECHNICAL INFORMATION SYSTEM: ANALYSIS PHASE
L. L. Holland Aug. 1985 29 p
(Contract DE-AC04-76DP-00613)
(DE85-018311; BDX-613-3272) Avail: NTIS HC A03/MF A01

The development of a Technical Information Management System for the Materials Evaluation Laboratory was undertaken to reduce the labor required to determine the flow of work within the laboratory, provide sample tracking, and to make the results of tests available to the requestor more quickly. The analysis phase of this development project is now complete. Structured Analysis and Information Analysis were used to reduce the total life cycle costs for the system. The deliverables produced during the analysis phase include data flow diagrams, process mini-specifications, data flow definitions, data element definitions, dialog definitions, the system record structure with navigational paths, and user implemen-

tation requirements. These deliverables comprise the functional system specification. It is easily understood by laboratory personnel, computer scientists, and supervision. The specification is also easily maintained to meet changing laboratory requirements. DOE

N86-17220# Allied Bendix Corp., Kansas City, Mo.
CLADS ANALYSIS DELIVERABLES, VOLUME 1 Final Report
L. L. Holland, W. G. Frede, M. E. Schleuter, S. E. Grant, H. H. Glass, and K. C. Atkinson Aug. 1985 394 p
(Contract DE-AC04-76DP-00613)
(DE85-018312; BDX-613-3273) Avail: NTIS HC A17/MF A01

The functional specification for the Laboratory Technical Information System is contained in Volumes 1 and 2 of the CLADS Analysis Deliverables. This specification is the result of applying Structured Analysis and Information Analysis to the Materials Evaluation Laboratory during the analysis phase of this project. Volume 1 includes 22 data flow diagrams (DFDs), a complete data dictionary containing data elements, data flows, and dialog definitions. Definitions also are included for 77 automated stores or files. These deliverables comprise the user's functional system specification and will be used as input to subsequent project phases, including software design. Volume 1 of the CLADS Analysis Deliverables contains Physical diagrams, Mini Specs, Automated Files, Manual Stores, and Dialog Definitions. DOE

N86-17221# Allied Bendix Corp., Kansas City, Mo.
CLADS ANALYSIS DELIVERABLES, VOLUME 2 Final Report
L. L. Holland, W. G. Frede, M. E. Schleuter, S. E. Grant, H. H. Glass, and K. C. Atkinson Aug. 1985 594 p
(Contract DE-AC04-76DP-00613)
(DE85-018313; BDX-613-3274) Avail: NTIS HC A25/MF A01

The functional specification for the Laboratory Technical Information System is contained in Volumes 1 and 2 of the CLADS Analysis Deliverables. This specification comes from applying Structured Analysis and Information Analysis to the Materials Evaluation Laboratory during the analysis phase of this project. Volume 1 includes 22 data flow diagrams (DFDs), a complete data dictionary containing data elements, data flows, and dialog definitions. Definitions also are included for 77 automated stores or files. These deliverables comprise the user's functional system specification and will be used as input to subsequent project phases, including software design. Volume 2 of the CLADS Analysis Deliverables covers Data Flow and Element Definitions. DOE

N86-17222# Sandia National Labs., Albuquerque, N. Mex.
SANDIA COMPUTERIZED SHOCK COMPRESSION BIBLIOGRAPHICAL DATABASE
J. S. Wilbeck, C. E. Anderson, J. C. Hokanson, J. R. Asay, D. E. Grady, R. A. Graham, and M. E. Kipp 1985 16 p Presented at the EXPLOMET '85 - International Conference on Metallurgical Applications of Shock Wave and High Strain-rate Phenomena, Portland, Oreg., 28 Jul. 1985 Prepared in cooperation with Winzen International, Inc., San Antonio, Tex. and Southwest Research Inst., San Antonio, Tex.
(Contract DE-AC04-76DP-00789)
(DE85-018542; SAND-85-0309C; CONF-850770-10) Avail: NTIS HC A02/MF A01

A searchable and updateable bibliographical database is being developed which will be designed, controlled, and evaluated by working technical experts in the field of shock-compression science. It will emphasize shock-compression properties in the stress region of a few tens of GPa and provide a broad and complete base of bibliographical information on the shock-compression behavior of materials. Through the operation of technical advisors, the database provides authoritative bibliographical and keyword data for use by both the inexperienced and expert user. In its current form, it consists of: (1) a library of journal articles, reports, books, and symposia papers in the areas of shock physics and shock mechanics; and (2) a computerized database system containing complete bibliographical information, exhaustive keyword descriptions, and author abstracts for each of the documents in the database library. DOE

N86-17223# Technische Hogeschool, Twente (Netherlands). Afdel. Transferpunt.
[ACTIVITIES REPORT IN KNOWLEDGE TRANSFER] Annual Report, 1984 [JAARVERSLAG 1984]
1984 18 p In DUTCH
Avail: NTIS HC A02/MF A01

Activities in the transfer of knowledge from university to society are outlined. The types of industries approaching the Transfer Point; part-time jobs for young entrepreneurs at the university; jobs for unemployed university graduates; the Dutch entrepreneur panel; public relations activities of the Transfer Point; international contacts; and Transfer Point consultations are discussed.
Author (ESA)

N86-16928# Joint Publications Research Service, Arlington, Va.
A NEW GENERATION OF ASPID INFORMATION RETRIEVAL SYSTEMS
G. K. Stolyarov, R. B. Grigyanets, and K. P. Kvachuk *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 25-27 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (USSR), no. 2, Mar-Apr. 1985 p 126.124 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

N86-16930# Joint Publications Research Service, Arlington, Va.
PARALLEL SEARCH IN A DISTRIBUTED DATABASE
V. G. Kerbel *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 41 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 1, Jan-Feb. 1985 p 63-73 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

N86-16931# Joint Publications Research Service, Arlington, Va.
ADAPTATION OF STOCHASTIC SEARCH METHODS IMPLEMENTED IN A HOMOGENEOUS COMPUTING ENVIRONMENT UNDER CONDITIONS OF UNCERTAINTY
N. N. Volk, V. O. Groppen, and E. A. Trakhtengerts *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 45-46 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 5, Sep.-Oct. 1984 p 83-91 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

N86-16932# Joint Publications Research Service, Arlington, Va.
ONE SOFTWARE IMPLEMENTATION OF A DIALOGUE INFORMATION RETRIEVAL SYSTEM
B. Ya. Kavalerchik, F. V. Birger, and K. K. Loginov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 51 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

N86-16933# Joint Publications Research Service, Arlington, Va.
MICROFILMING OF SCIENTIFIC AND TECHNICAL INFORMATION SOURCE DOCUMENTS WITH FEW COLORS
L. I. Brodolin, A. Z. Kan, S. I. Kuznetsova, and I. I. Marshak *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-85-005) 28 Aug. 1985 p 52 Transl. into ENGLISH from Nauchno-Tekhnicheskaya Informatsiya Seriya I. Organizatsiya i Metodika Informatsionnoy Raboty (Moscow, USSR), no. 3, Mar. 1985 p 27-31 (For primary document see N86-16924 07-60)
Avail: NTIS HC A05

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-17224*# IIT Research Inst., Chicago, Ill. Nonmetallic Materials and Composites.

LONG-TERM STABILITY AND PROPERTIES OF ZIRCONIA CERAMICS FOR HEAVY DUTY DIESEL ENGINE COMPONENTS Final Report

David C. Larsen and Jane W. Adams Sep. 1985 263 p refs (Contracts DEN3-305; DE-AI01-80CS-50194)
(NASA-CR-174943; DOE/NASA/0305-1; NAS 1.26:174943) Avail: NTIS HC A12/MF A01 CSCL 13F

Physical, mechanical, and thermal properties of commercially available transformation-toughened zirconia are measured. Behavior is related to the material microstructure and phase assemblage. The stability of the materials is assessed after long-term exposure appropriate for diesel engine application. Properties measured included flexure strength, elastic modulus, fracture toughness, creep, thermal shock, thermal expansion, internal friction, and thermal diffusivity. Stability is assessed by measuring the residual property after 1000 hr/1000C static exposure. Additionally static fatigue and thermal fatigue testing is performed. Both yttria-stabilized and magnesia-stabilized materials are compared and contrasted. The major limitations of these materials are short term loss of properties with increasing temperature as the metastable tetragonal phase becomes more stable. Fine grain yttria-stabilized material (TZP) is higher strength and has a more stable microstructure with respect to overaging phenomena. The long-term limitation of Y-TZP is excessive creep deformation. Magnesia-stabilized PSZ has relatively poor stability at elevated temperature. Overaging, decomposition, and/or destabilization effects are observed. The major limitation of Mg-PSZ is controlling unwanted phase changes at elevated temperature. Author

N86-17225*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RESEARCH AND TECHNOLOGY FISCAL YEAR 1985 REPORT Annual Report

Fred Speer Nov. 1985 136 p
(NASA-TM-86532; NAS 1.15:86532) Avail: NTIS HC A07/MF A01 CSCL 05A

A quarter of a century is but a moment on the cosmic calendar. Now that Marshall Space Flight Center has reached its 25th Anniversity, it seems just moments ago that President Dwight D. Eisenhower stood on these grounds and formally dedicated the George C. Marshall Space Flight Center in Huntsville, Alabama. The Fiscal Year 1985 Research and Technology Report reflects the wide spectrum of activities closely linked with the Center's mainstream spaceflight developments. Past accomplishments testify to the success of getting deeply involved in the science and technology of its projects - 32 Saturn launches, Pegasus, the Skylab missions, three High Energy Astronomy Observatory missions, the Apollo - Soyuz mission, and an accelerating schedule of successful Shuttle, Spacelab, and Shuttle payload missions. The Center continues to be involved in engineering development, scientific research, and technology. At the beginning of the second quarter century, the experience and dedication of the engineers and scientists, and the success of the collaboration with industry and academia will now be aimed at the next great endeavor, the Space Station. Author

N86-17226*# American Trucking Associations, Inc., Alexandria, Va.

FUTURE HEAVY DUTY TRUCKING ENGINE REQUIREMENTS Final Report

Larry W. Strawhorn and Victor A. Suski Mar. 1985 166 p refs (Grant NAG3-457; Contract DE-AI01-80CS-50194)
(NASA-CR-174996; DOE/NASA/0457-1; NAS 1.26:174996) Avail: NTIS HC A08/MF A01 CSCL 13F

Developers of advanced heavy duty diesel engines are engaged in probing the opportunities presented by new materials and techniques. This process is technology driven, but there is neither assurance that the eventual users of the engines so developed will be comfortable with them nor, indeed, that those consumers will continue to exist in either the same form, or numbers as they do today. To ensure maximum payoff of research dollars, the equipment development process must consider user needs. This study defines motor carrier concerns, cost tolerances, and the engine parameters which match the future projected industry needs. The approach taken to do that is to be explained and the results presented. The material to be given comes basically from a survey of motor carrier fleets. It provides indications of the role of heavy duty vehicles in the 1998 period and their desired maintenance and engine performance parameters. Author

N86-17227*# Ecosystems International, Inc., Crofton, Md.

ASSESSMENT OF US INDUSTRY'S TECHNOLOGY TRENDS AND NEW TECHNOLOGY REQUIREMENTS Final Report

Oct. 1984 184 p
(Contract NASw-3674)
(NASA-CR-176479; NAS 1.26:176479) Avail: NTIS HC A09/MF A01 CSCL 05A

The utility and effectiveness of a novel approach (the Applications Development, or AD approach), intended to augment the efficiency of NASA's technology utilization (TU) through dissemination of NASA technologies and joint technology development efforts with U.S. industry is tested. The innovative AD approach consists of the following key elements: selection of NASA technologies appearing to have leading edge attributes; interaction with NASA researchers to assess the characteristics and quality of each selected technology; identification of industry's needs in the selected technology areas; structuring the selected technologies in terms of specifications and standards familiar to industry (industrial Spec. Sheets); identification and assessment of industry's interest in the specific selected NASA technologies, utilizing the greatly facilitated communication made possible by the availability of the industrial Spec. Sheets; and matching selected NASA technologies with the needs of selected industries. Author

N86-17228*# Rural Enterprises, Durant, Okla.

[RURAL ENTERPRISES, INCORPORATED REPORT OF SIGNIFICANT ACTIVITIES AND ACCOMPLISHMENTS] Quarterly Status Report, period ending 30 Sep. 1985

Oct. 1985 51 p
(Contract NASw-3963)
(NASA-CR-176362; NAS 1.26:176362) Avail: NTIS HC A04/MF A01 CSCL 05A

The ongoing activities of Rural Enterprises, Inc. are presented.

The function of Rural Enterprises is to bring innovation from its rudimentary conceptual stages to useful and productive ends by means of cooperation with government, business, and educational institutions. G.L.C.

N86-17229# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES, VOLUME 39, NUMBER 10 Monthly Publication
L. E. Shaffer Oct. 1985 54 p
(AD-A159263; AD-E301788; ESN-39-10) Avail: NTIS HC A04/MF A01 CSCL 05/2

Among the subjects reported in this issue are: The European Assoc. for Research on Learning and Instruction--The intersection between problem solving, cognition-motivation interaction, and individual differences; Electrochemistry conferences; MODULEF--A modular finite element program package (France); Plansee Seminar--Progress in Powder Metallurgy; The closing of the Inst. for Oceanographic Sciences labs, Taunton, England, has led to the complete disbandment of the sedimentation group (SG) there--review of the SG's work in cohesive and noncohesive sediments and shelf sediment dynamics; A Review of the Present State of the Art at Fibre Optics '85; Optoelectronics at Univ. Coll., London; and Super-ACO Construction at Orsay -- An 800 MeV, 500 milliAngstrom synchrotron light source positron storage ring. GRA

N86-17230# Pacific Northwest Lab., Richland, Wash.
TECHNOLOGY TRANSFER IS OPPORTUNITY TRANSFER
T. M. Levinson, L. C. Schmid, and R. L. Watts Jun. 1985 11 p Presented at the 10th Annual Meeting of the Technology Transfer Society, San Francisco, Calif., 24 Jun. 1985
(Contract DE-AC06-76RL-01830)
(DE85-016622; PNL-SA-12976; CONF-8506175-1) Avail: NTIS HC A02/MF A01

The management of intellectual property and the decision process of selecting federal technologies for transfer is approached from the perspective of how they can be packaged as business opportunities. The package is usually provided by a technologist who is the technology provider and the opportunity must be perceived as such by the business person. Thoughts are provided on the different perspectives of the technology provider and the technology seeker and the environment in which the transfer process occurs. The different perspectives and the environment can cause a disconnect between the research result and its uses. By using selection criteria based on the business person's perspective and by presenting the technology in terms of what it can become helps to mitigate this disconnect. DOE

N86-17231# Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology.
ELECTRIC VEHICLE CHARGER TEST PLAN. REVISION 1
R. L. Driggans, R. W. Reese, and A. S. Keller May 1985 35 p
(DE85-901749; TVA/PE/EDT-85/10-Rev-1) Avail: NTIS HC A03/MF A01

This report describes the revised test plan developed under the battery charger testing work task of the Electric Power Research Institute (EPRI)/Tennessee Valley Authority (TVA) electric vehicle project. This test plan covers the tests performed and the procedures used to evaluate chargers. Measurements made during testing include (1) charger-induced distortion of input signals, (2) charger output characteristics, and (3) charger-induced radio frequency interference to communication equipment. Additionally, operating efficiencies are calculated and physical characteristics are noted. The testing is performed using precision volt-amp-watt meters, frequency counters, a digital storage oscilloscope, and a spectrum analyzer. DOE

N86-17232# Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology.
TEST AND EVALUATION REPORT FOR THE BEDFORD CF ELECTRIC VAN
R. L. Driggans, G. D. Whitehead, and R. K. Buffett Apr. 1985 87 p
(DE85-901750; TVA/PE/EDT-85/11) Avail: NTIS HC A05/MF A01

The Bedford Van was tested in test track, chassis dynamometer, and urban-road settings. Vehicle dc energy consumption and driving range were measured on the SAE J227a C schedule driving cycle, the TVA urban driving route, and at constant speeds. Other tests measured the top speed, maximum acceleration, hill climbing, and braking performance of the vehicle. This report presents test results, data on vehicle operating characteristics, descriptions of the vehicle and components, and information on reliability during the test period. DOE

N86-17233# Netherlands Agency for Aerospace Programs, Delft.
[ACTIVITIES REPORT IN AIRCRAFT DEVELOPMENT AND ASTRONAUTICS] Annual Report, 1984 [VERSLAG VAN DE WERKZAAMHEDEN 1984]
1984 34 p In DUTCH
Avail: NTIS HC A03/MF A01

The Fokker 50 and the Fokker 100 aircraft development activities are reviewed. The data acquisition, recording, and evaluation system for flight tests with prototypes, the Airbus, and the Shorts SD 330/360 is described. Contributions to the IRAS-project; and ESA-programs (telecommunication satellites, Ariane, Eureca, microgravity, Earth observation, Spacelab, Columbus) are summarized. Author (ESA)

N86-17234# National Technical Information Service, Springfield, Va. Center for the Utilization of Federal Technology.
REPORT OF ACTIVITIES FROM FY 1983 - FY 1984 PURSUANT TO SECTION 2 OF THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT
Apr. 1985 288 p
(PB85-184026) Avail: NTIS HC A13/MF A01 CSCL 05D

Section 11(e) of the Stevenson-Wydler Technology Innovation Act of 1980 requires each Federal agency that operates or directs one or more Federal laboratories to report its technology transfer activities to the Center for the Utilization of Federal Technology (CUFT) every other year. The Center for the Utilization of Federal Technology has received reports from all ten agencies operating laboratories that fall within the scope of the Stevenson-Wydler Technology Innovation Act. In response to the request for changes that have occurred in an Agency's program since October 1, 1982, Agencies supplied information on the range of their ongoing technology transfer activities. This report highlights the progress being made in each Agency as their technology transfer programs have grown in the second biennial period since passage of the Stevenson-Wydler Technology Innovation Act of 1980. Author (GRA)

88 SPACE SCIENCES (GENERAL)

N86-17235*# Columbia Univ., New York.
MULTIDISCIPLINARY RESEARCH IN THE SPACE SCIENCES Final Technical Report
W. S. Broecker and G. W. Flynn 31 Dec. 1983 32 p refs
(Contracts NCC5-16; NCC5-28; NCC5-29)
(NASA-CR-176451; NAS 1.26:176451) Avail: NTIS HC A03/MF A01 CSCL 03C

Research activities were carried out in the following areas during this reporting period: (1) astrophysics; (2) climate and atmospheric modeling; and (3) climate applications of earth observations & geological studies. An ultra-low-noise 115 GHz receiver based upon a superconducting tunnel diode mixer has been designed and constructed. The first laboratory tests have yielded spectacular results: a single-sideband noise temperature of 75 K considerably more sensitive than any other receiver at this frequency. The receiver will replace that currently in use on the Columbia-GISS CO Sky Survey telescope. The 1.2 meter millimeter-wave telescope at Columbia University has been used

to complete two large-scale surveys of molecular matter in the part of the inner galaxy which is visible from the Northern hemisphere (the first galactic quadrant); one of the distant galaxy and one of the solar neighborhood. The research conducted during the past year in the climate and atmospheric modeling programs has been focused on the development of appropriate atmospheric and upper ocean models, and preliminary applications of these models. Principal models are a one-dimensional radiative-convective model, a three-dimensional global climate model, and an upper ocean model. During the past year this project has focused on development of 2-channel satellite analysis methods and radiative transfer studies in support of multichannel analysis techniques. B.W.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-17236 Rice Univ., Houston, Tex.
A SURFACE PHOTOMETRIC STUDY OF NGC 5138 Ph.D. Thesis
Robert Lee Pennington 1985 130 p
Avail: Univ. Microfilms Order No. DA8517230

Calibrated digital surface photometry in the standard UBV passbands has been used to prepare two dimensional maps to examine the structure and stellar populations in NGC 5128(Cen A). The main body of the galaxy exhibits colors and stellar populations slightly bluer than those of an old elliptical galaxy out to r approx. 176'. Beyond this radius, excess emission on the inner halo contributes significantly to the U passband only, probably due to line emission from material swept into the halo from the dust lane. Four large diffuse arcs have been detected on the B-V raster. The outermost two are in the northern hemisphere and have similar B-V colors of approx. -0.11. The innermost pair are on opposite sides of the nucleus at r approx. 107' with B-V = 0.08, suggesting that a ring or sphere may exist at this radius, centered on the nucleus. Dissert. Abstr.

N86-17237 Iowa Univ., Iowa City.
INFRARED PHOTOMETRY AND HIGH-RESOLUTION IMAGING OF OH/IR STARS Ph.D. Thesis
Michael L. Cobb 1985 202 p
Avail: Univ. Microfilms Order No. DA8518813

The infrared properties of the circumstellar shells surrounding several OH/IR stars were investigated by photometry and high-resolution imaging techniques. Filter photometry from 2 to 20 microns implies color temperatures in the 10 micron region ranging from 400 K to 600 K showing that the effective temperature decreases with increasing wavelength. The assumption that the 10 micron feature is intrinsic to the sources and due to opacity effects within the shell was investigated and found to be consistent. The high-resolution technique of speckle interferometry combined with the Know-Thompson image recovery algorithm is compared with that of the shift-add technique. The reconstructed images are dominated by a strong unresolved central source surrounded by a diffuse partially resolved shell. The wavelength dependence of the size of the emitting region and the ratio of the flux from the shell to the central component is found. The diameters are proportional to the wavelength of observation and the relative contribution of the shell increases with wavelength also. The infrared observations, when compared with the radio OH maps obtained from the VLA, imply a bipolar mass outflow. It appears that the infrared observations detect the polar lobes while the OH emission is confined to the equatorial region. Dissert. Abstr.

N86-17238 Massachusetts Univ., Amherst.
THE MASSACHUSETTS-STONY BROOK GALACTIC PLANE CO SURVEY: OBSERVATIONS, GALACTIC STRUCTURE AND CLOUD IDENTIFICATION Ph.D. Thesis
Dan Percival Clemens 1985 235 p
Avail: Univ. Microfilms Order No. DA8517090

The observing parameters for a galactic plane CO survey consisting of 40,551 spectra with 301 km s/1 coverage at 1km s/1 resolution are presented. The mostly 3 x 3' sky sampling with a 45 in. beam enables detection of virtually all galactic clouds larger than 10 to 20 pc in the northern plane. A rotation curve for the northern disk was determined. Large-scale streaming motions with characteristic velocities of 5 km s/1 and wavelengths of 2 kpc are identified. The LSR is found to have an azimuthal peculiar velocity of 7 + or - 1.5 km s/1 with respect to the molecular cloud system. A combination of appropriate (l,V) binning and cluster analysis were used to extract near and far-side emission parameters from the different angular width components present in latitude emission profiles. The face-on distribution of molecular ring feature. An automated cloud identification system was developed and used on the entire CO survey data set. The 112 clouds found in the select region using the automated means are compared to those found by Stark in a subset of this region using CO13. The agreement between the clouds is good. Dissert. Abstr.

N86-17239*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STAR FORMATION IN THE INNER GALAXY: A FAR-INFRARED AND RADIO STUDY OF TWO H2 REGIONS
D. F. Lester (Texas Univ., Austin), H. L. Dinerstein (Texas Univ., Austin), M. W. Werner, P. M. Harvey, N. J. Evans, II (Texas Univ., Austin), and R. L. Brown (National Radio Astronomy Observatory, Charlottesville, Va.) Dec. 1985 40 p refs
(NASA-TM-88184; Rept-86008; NAS 1.15:88184; Preprint-38)
Avail: NTIS HC A03/MF A01 CSCL 03A

Far-infrared and radio continuum maps have been made of the central 6' of the inner-galaxy H II regions G30.8-0.0 (in the W43 complex) and G25.4-02., along with radio and molecular line measurements at selected positions. An effort is made to understand far infrared wavelengths allow the dust temperature structures and total far infrared fluxes to be determined. Comparison of the radio and infrared maps shows a close relationship between the ionized gas and the infrared-emitting material. There is evidence that parts of G30.8 are substantially affected by extinction, even at far-infrared wavelengths. For G25.4-0.2, the radio recombination line and CO line data permit resolution of the distance ambiguity for this source. The confusion in distance determination is found to result from an extraordinary near-superposition of two bright H II regions. Using revised distances of 4.3 kpc for G26.4SE and 12 kpc for G25.4NW, that the latter, which is apparently the fainter of the two sources, is actually the more luminous. Though it is not seen on the Palomar Sky Survey, G25.4SE is easily visible in the 9532A line of [S III] and is mapped in this line. The ratio of total luminosity to ionizing luminosity is very similar to that of H II regions in the solar circle. Assuming a coeval population of ionizing stars, a normal initial mass function is indicated. Author

N86-17240*# Los Alamos National Lab., N. Mex. Group T-6.
HYDRODYNAMIC MODELS FOR NOVAE WITH EJECTA RICH IN OXYGEN, NEON AND MAGNESIUM
Sumner Starrfield, Warren M. Sparks, and James W. Truran (Illinois Univ., Chicago) [1985] 14 p refs
(Grants NAG5-481; NSF AST-83-14788; NSF AST-83-14415)
(NASA-CR-176475; NAS 1.26:176475) Avail: NTIS HC A02/MF A01 CSCL 03A

The characteristics of a new class of novae are identified and explained. This class consists of those objects that have been observed to eject material rich in oxygen, neon, magnesium, and aluminum at high velocities. We propose that for this class of novae the outburst is occurring not on a carbon-oxygen white dwarf but on an oxygen-neon-magnesium white dwarf which has evolved from a star which had a main sequence mass of approx. 8 solar masses to approx. 12 solar masses. An outburst was simulated by evolving 1.25 solar mass white dwarfs accreting hydrogen rich material at various rates. The effective enrichment of the envelope by ONeMg material from the core is simulated by enhancing oxygen in the accreted layers. The resulting evolutionary sequences can eject the entire accreted envelope plus core

material at high velocities. They can also become super-Eddington at maximum bolometric luminosity. The expected frequency of such events (approx. 1/4) is in good agreement with the observed numbers of these novae. Author

N86-17241# Los Alamos National Lab., N. Mex.
PERFORMANCE EVALUATION OF THE ANTARES REFERENCE TELESCOPE SYSTEM
J. R. Parker, G. L. Woodfin, and V. K. Viswanathan 1985 9 p Presented at the Southwest Conference on Optics '85, Albuquerque, N. Mex., 4-8 Mar. 1985
(Contract W-7405-eng-36)
(DE85-015733; LA-UR-85-2721; CONF-850345-29) Avail: NTIS HC A02/MF A01

The Antares Reference Telescope System is a complicated electro-optical-mechanical system whose main purpose is to enable positioning of targets used in the Antares Laser System to within 10 microns of a selected nominal position. To date, it has been used successfully to position targets ranging in size from 300 microns to 2 mm. The system consists of two electro-optical systems positioned in a nearly orthogonal manner. This cross telescope configuration facilitates accurate positioning in three planes. The results obtained so far in resolution and positioning of targets using this system are discussed. It is shown that a resolution of 200 lp/mm and a positioning precision of 25 microns can be obtained. Author

N86-17242# Royal Observatory, Edinburgh (Scotland).
THE UK SCHMIDT TELESCOPE OBJECTIVE PRISMS. 2: CATALOGUE OF OBJECTS AND TECHNICAL DATA
Ann Savage, J. Duncan Waldron, David H. Morgan, Susan B. Tritton, Russell D. Cannon, John A. Dawe, Mary T. Bruck (Edinburgh Univ.), Steven M. Beard (Edinburgh Univ.), and John B. Palmer (Edinburgh Univ.) 1985 68 p refs
(ISBN-0-902553-35-6-Pt-2) Avail: NTIS HC A04/MF A01

Galactic and extragalactic objects as they appear on UKST prism plates are described so that specific classes of objects can more easily be identified. Two spectral classification schemes, at dispersion 2400 A/mm at 4300 A, and 800 A/mm at 4300 A are described. The limitations of the prism combinations with respect to dispersion and resolution the effects of seeing and exposure time on the appearance of the spectra and the wavelength sensitivity responses of the two major emulsions in use, IIIa-J and the IIIa-F are discussed. Author (ESA)

N86-17243# Royal Observatory, Edinburgh (Scotland).
THE UK SCHMIDT TELESCOPE OBJECTIVE PRISMS. 3: ILLUSTRATIONS OF OBJECTIVE PRISM SPECTRA
Ann Savage, Duncan J. Waldron, Marjorie Fretwell, David H. Morgan, Susan B. Tritton, Russel D. Cannon, Mary T. Bruck (Edinburgh Univ.), Steven M. Beard (Edinburgh Univ.), and John B. Palmer (Edinburgh Univ.) 1985 28 p
(ISBN-0-902553-36-4-Pt-3) Avail: NTIS HC A03/MF A01

Galactic and extragalactic objects photographed by the UK Schmidt telescope objective prisms are presented. Faint stellar spectral type standard stars; emission-line quasars; stars mistaken for quasar candidates; absorption-line galaxies; emission-line galaxies; extragalactic HII regions; planetary nebulae; emission-line stars; Wolf Rayet, carbon, and M stars; and HD standard stars are shown. Author (ESA)

N86-17244# Groningen Rijksuniversiteit (Netherlands). Lab. for Space Research.
SHORT WAVELENGTH SPECTROMETER FOR THE INFRARED SPACE OBSERVATORY (ISO). A PROPOSAL TO THE EUROPEAN SPACE AGENCY
1985 88 p refs Sponsored in cooperation with Max-Planck Inst. fuer Extraterestrische, Garching, West Germany and Utrecht State Univ., Netherlands
Avail: NTIS HC A05/MF A01

A spectrometer for the Infrared Space Observatory, designed to operate in the wavelength region from 3 to 50 microns with resolutions ranging from 3000 to 100,000 is proposed. It can study interstellar matter, star formation and evolution, extragalactic systems, and the solar system. The wide wavelength range includes numerous atomic, ionic and molecular transitions as well as diffuse features. They provide tools for studies of the physical and chemical processes of regions optically hidden by interstellar dust. The high resolving power allows probing of kinematic processes objects ranging from galactic nuclei to planetary atmospheres. Line studies of extragalactic objects, out to distances equal to the Virgo cluster, can be carried out. Direct observation of ground state molecular hydrogen in the interstellar medium can be attempted.
Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-17245 Yale Univ., New Haven, Conn.
THE STRUCTURE OF BRIGHTEST CLUSTER GALAXIES Ph.D. Thesis
James Moeller Schombert 1984 208 p
Avail: Univ. Microfilms Order No. DA8514685

Faint surface photometry of bright ellipticals in the cores of galaxy clusters, combined with photometry from within the literature, produced a sample of 261 ellipticals in 63 clusters over a magnitude range of -18 > or = M sub v > or = -25. Fitting functions, particularly the r1/4 law and the Hubble-Oemier law, are applied to the data; however, results are ambiguous and have compelled the use of empirical quantities such as isophotal radii, characteristic surface brightnesses and integrated magnitudes determined directly from surface brightness profiles themselves to analyze structure. There is strong evidence to show that structure is a well correlated and mooth function of luminosity, and that generalized profiles can be constructed as templates to describe the average structure of ellipticals as one parameter (luminosity) family. BCMs (brightest cluster members) have particular traits that, as a class of objects, distinguishes them structurally from normal ellipticals. These differences can be attributed to enlarged charactristic radii, and shallow profile slopes. Dissert. Abstr.

N86-17246 State Univ. of New York, Stony Brook.
ELECTROMAGNETIC TORQUES AND ALIGNMENT OF NEUTRON STARS Ph.D. Thesis
Kim Kwee Ng 1985 93 p
Avail: Univ. Microfilms Order No. DA8518373

Certain consequences of the high magnetic field associated with a rotating neutron star were studied. A general equation for the electromagnetic torque on the star is formulated. This consists of two distinct contributions, i.e. a retardation torque and a magnetospheric torque acting on the star. The retardation torque results naturally from a mathematical treatment of the retardation correction to the magnetic field of the star. A torque obtained from a Taylor series expansion was identified as a third-order term and its component along the rotation axis is consistent with the classical decelerating torque known in the past. The magnetospheric torque which results from the currents in the magnetosphere, is identified and included in the calculation. There is, however, no anomalous effeect on the alignment and spindown rate of the star. The calculation is extended to the quadrupole moment of the star. It is found that there is no effective aligning torque or anomalous spindown effect from the rotating quadrupole field of the star. The alignment of the star and a possible twisting motion about the dipole moment of the star are discussed.
Dissert. Abstr.

N86-17247# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Astrophysik.
DISSOCIATIVE RECOMBINATION OF INTERSTELLAR IONS: ELECTRONIC STRUCTURE CALCULATIONS FOR HCO(+)
W. P. Kraemer and A. U. Hazi 2 Jul. 1985 16 p refs Presented at the NATO Advanced Study Institute on Molecular Astrophysics:

State of the Art and Future Directions, Garching, West Germany, 1 Jul. 1984 Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE85-017261; UCRL-92919; CONF-8407142-1) Avail: NTIS HC A02/MF A01

A study of the interstellar formyl ion HCO(+) is the first attempt to investigate dissociative recombination for a triatomic molecular ion using an entirely theoretical approach. A number of fairly extensive electronic structure calculations that were performed to determine the reaction mechanism of the e-HCO(+) process are described. Similar calculations for the isoelectronic ions HOC(+) and HN2(+) are in progress. DOE

N86-17248# California Univ., Berkeley. Lawrence Berkeley Lab.
SUPERGRAVITY AND INFLATION
P. Binetruy Aug. 1985 27 p refs Presented at the 6th Workshop on Grand Unification, Minneapolis, Minn., 18 Apr. 1985
(Contract DE-AC03-76SF-00098)
(DE86-000608; LBL-20092; CONF-8504178-1) Avail: NTIS HC A03/MF A01

The reasons that led to study supersymmetric models in the context of inflation are reviewed by setting up the constraints that candidates to an inflationary scenario must satisfy. The question is raised whether the groundstate of the new scalar field introduced, the inflation, breaks supersymmetry. This is discussed in connection with the so-called thermal constraint. Some problems about the study of thermal fluctuations are discussed. The different models available are reviewed and the way they address those issues. A discussion of baryon number generation and of the gravitation problem follows. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N86-17249 California Inst. of Tech., Pasadena.
THEORETICAL STUDIES OF 10'S ATMOSPHERE Ph.D. Thesis
Michael Earl Summers 1985 159 p
Avail: Univ. Microfilms Order No. DA8508475

A range of theoretical models of the compositional structure of Io's dayside atmosphere and ionosphere are developed. The dominant neutral gas, SO2, is provided by sublimation of surface frost. Photochemical processes lead to the build up of O, S, SO, and O2 as minor gasses near Io's surface while O becomes the dominant gas near the exobase. The vertical column density of O2 in all models considered is less than 10 to the 14th power/sq cm. The dayside ionosphere is formed as a result of ionization of neutral species by solar UV radiation. Charge exchange and rearrangement reactions are important for determining the ionic composition of the ionosphere. The dominant ion in the models considered is SO+. A number of charge exchange reactions are identified whose rates need to be better determined in order to refine the present model of the ionosphere. The best matches of the model ionospheres to that observed by the Pioneer 10 radio occultation experiment require atmospheric surface concentrations of SO2 in the range of 2.5 x 10 to the 9th power to 1 x 10 to the 11th power/cu cm, and an exospheric temperature in the range of 960 K to 1230 K. Dissert. Abstr.

N86-17250 George Washington Univ., Washington, D.C.
COMPRESSIONAL DEFORMATION AND TECTONIC EVOLUTION OF THE THARSIS REGION OF MARS Ph.D. Thesis
Thomas Robert Watters 1985 267 p
Avail: Univ. Microfilms Order No. DA8514513

The Tharsis region of Mars is dominated by volcanic and tectonic features. The major structural features observed throughout the region are ridges and faults. The Tharsis ridges are morphologically similar to ridges observed on the Moon, Mercury and the Columbia Plateau on Earth. The interpretation of the Columbia Plateau ridges as anticlinal folds forms a strong basis for the interpretation of the Tharsis ridges as compressional folds. The Tharsis ridge system is, to a first approximation, circumferentially oriented around the regional topographic high of northern Syria Planum. Ridge-fault crosscutting relations on the ridged plains indicate that the major ridge forming events in the Tharsis region were coincident with, and in many cases, prior to the extensional events that generated the faulting of the Tempe, Coprates and Memnonia regions and the rifting of Valles Marineris. Based on superposition relations, the compressional events that generated the ridges occurred after the emplacement of the ridged plains volcanic units and did not extend beyond the emplacement of the Syria Planum Formation or Tharsis Formation volcanic units. Dissert. Abstr.

N86-17251*# Massachusetts Univ., Amherst.
STUDIES OF RADIATIVE TRANSFER IN PLANETARY ATMOSPHERES Semiannual Status Report, 1 Jun. - 30 Nov. 1985
William M. Irvine and F. Peter Schloerb 15 Jan. 1986 7 p
(Grant NGL-22-010-023)
(NASA-CR-176466; NAS 1.26:176466; SASR-37) Avail: NTIS HC A02/MF A01 CSCL 03B

The research emphasis during the period of this report has been on radio observations of comets, related to the International Halley Watch. Observations of the 18 cm lambda-doublet of OH have been carried out monthly. Both of the 1667 and 1665 MHz lines have been repeatedly detected for Comets Halley, Giacobini-Zinner, Thiele, and Hartley-Good. The first astronomical detection of the weak satellite line at 1720 MHz was made for P/Halley. These data promise to supply the highest signal-to-noise-ratio data over an extended period ever obtained for cometary radio observations. Analysis will provide gas production rates as a function of heliocentric distance and allow for detailed comparisons with the OH excitation model involving ultraviolet pumping. In the case of Halley, the lines appear quite symmetric, usually being centered within 0.1 km/s with respect to the nominal nuclear velocity. Line widths have been typically within 10% of 2 km/s. There is thus little evidence for asymmetric emission in the data obtained to date. It seems likely that non-steady-state models of the coma will be required to interpret the data. Evidence for significant departures from the LTE hyperfine ratios was found for Comet Giacobini-Zinner. Smaller, but nonetheless significant, deviations have been found for Comet Halley. B.W.

N86-17252*# Alaska Univ., Fairbanks.
OPTICAL OBSERVATIONS OF THE AMPTE ARTIFICIAL COMET AND MAGNETOTAIL BARIUM RELEASES Yearly Report
Thomas J. Hallinan, Hans Stenbaek-Nielsen, and Neal Brown Nov. 1985 17 p
(Grant NAG5-493)
(NASA-CR-176463; NAS 1.26:176463; YR-1) Avail: NTIS HC A02/MF A01 CSCL 03B

The first AMPTE artificial comet was observed with a low light level television camera operated aboard the NASA CV990 flying out of Moffett Field, California. The comet head, neutral cloud, and comet tail were all observed for four minutes with an unifiltered camera. Brief observations at T + 4 minutes through a 4554A Ba(+) filter confirmed the identification of the structures. The ion cloud expanded along with the neutral cloud at a rate of 2.3 km/sec (diameter) until it reached a final diameter of approx. 170 km at approx. T + 90 s. It also drifted with the neutral cloud until approx. 165 s. By T + 190 s it had reached a steady state velocity of 5.4 km/sec southward. A barium release in the magnetotail was observed from the CV990 in California, Eagle, Alaska, and Fairbanks, Alaska. Over a twenty-five minute period, the center of the barium streak drifted southward (approx. 500 m/sec), upward (24 km/sec) and eastward (approx 1 km/sec) in a nonrotating reference frame. An all-sky TV at Eagle showed a single auroral arc in the far North during this period. Author

N86-17253# Lawrence Livermore National Lab., Calif.
SHOCK TEMPERATURE MEASUREMENTS IN AMMONIA
H. B. Radousky, A. C. Mitchell, N. J. Nellis, and M. Ross Jul. 1985 7 p Presented at the American Physics Society Topical Conference on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985
(Contract W-7405-eng-48)
(DE85-014810; UCRL-92921; CONF-850736-27) Avail: NTIS HC A02/MF A01

Our first shock temperature measurements on a cryogenic target are reported for NH3. A new fast optical pyrometer and a cryogenic specimen holder for liquid NH3 were developed to measure shock temperatures of 4400 and 3600 K at pressures of 61 and 48 GPa. These conditions correspond to those in the ice layers in Uranus and Neptune. The shock temperature data are in reasonable agreement with an equation of state based on an intermolecular potential derived from NH3 Hugoniot data. DOE

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-17254# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARABLE ENERGY RELEASE RATES AT THE ORIGIN OF SMALL AND LARGE SOLAR BURSTS
P. Kaufmann Jun. 1985 6 p refs Sponsored in part by FINEP Submitted for publication
(INPE-3557-PRE/767) Avail: NTIS HC A02/MF A01

The discovery that the simplest impulsive solar bursts at microwaves and hard X-rays have time scales in the range of 10-100 milliseconds suggest that the energy release rates in such small events are comparable to rates attributed to large events. This condition may be reconciled to the concept that observed burst fluxes in solar events are the convolution of many fast primary energetic injections, at various repetition rates. Author

N86-17255*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Dept. of Physics and AStronomy.
THE HEAVY ION COMPOSITIONAL SIGNATURE IN 3He-RICH SOLAR PARTICLE EVENTS
G. M. Mason (Maryland Univ., College Park), D. V. Reames, B. Klecker (Max-Planck-Institut fuer Physik und Astrophysik, Munich, West Germany), D. Hovestadt (Max-Planck-Institute fuer Physik und Astrophysik, Munich, West Germany), and T. T. VonRosenvinge 7 Oct. 1985 53 p refs Submitted for publication
(Contract NAS5-28704; Grants NAGw-101; NGR-21-002-224/316; Contract FRG-RV-14-B8/74; Grant NSF ATM-84-07546)
(NASA-CR-177831; NAS 1.26:177831; PP-86-59) Avail: NTIS HC A04/MF A01 CSCL 03B

A survey of the approx. 1 MeV/nucleon heavy ion abundances in 66 He3-rich solar particle events was performed using the Max-Planck-Institut/University of Maryland and Goddard Space Flight Center instruments on the ISEE-3 spacecraft. The observations were carried out in interplanetary space over the period 1978 October through 1982 June. Earlier observations were confirmed which show an enrichment of heavy ions in HE3-rich events, relative to the average solar energetic particle composition in large particle events. For the survey near 1.5 MeV/nucleon the enrichments compared to large solar particle events are approximately He4:C:O:Ne:Mg:Si:Fe = 0.44:0.66:1.:3.4:3.5:4.1:9.6. Surprising new results emerging from the present broad survey are that the heavy ion enrichment pattern is the same within a factor of approx. 2 for almost all cases, and the degree of heavy ion enrichment is uncorrelated with the He3 enrichment. Overall, the features established appear to be best explained by an acceleration mechanism in which the He3 enrichment process is not responsible for the heavy ion enrichment, but rather the heavy ion enrichment is a measure of the ambient coronal composition at the sites where the He3-rich events occur. Author

N86-17256# Oak Ridge National Lab., Tenn.
FEASIBILITY OF Br-81(nu, e(-))Kr-81 SOLAR NEUTRINO EXPERIMENT
G. S. Hurst, S. L. Allman, C. H. Chen, S. D. Kramer, J. O. Thomson, and B. Cleveland May 1985 8 p refs Presented at the 7th International Conference on Laser Spectroscopy, Maui, Hawaii, 24 Jun. 1985 Prepared in cooperation with Tennessee Univ., Knoxville and Brookhaven National Lab., Upton, N.Y.
(Contract DE-AC05-84OR-21400)
(DE85-016380; CONF-850605-4) Avail: NTIS HC A02/MF A01

Several ingenious solutions have been offered for the solar neutrino problem - a defect in the solar model, the appearance of a new type of neutrino physics, the Sun is no longer burning, etc. The range of these proffered solutions stresses the need for a new experiment to study the Sun. The modern pulsed laser now makes possible a new solar neutrino test which examines an independent neutrino source in the Sun. A recently proposed experiment would use the reaction Br-81(nu,e(-))Kr-81 to measure the flux of Be-7 neutrinos from the Sun. When Be-7 decays by electron capture to make Li-7, a neutrino is emitted at 0.862 MeV and the flux of these on the Earth is about 4 x 10 to the 9th power sq cm/s, according to the standard model. Therefore, an experiment based on Br-81(nu,e(-))Kr-81 which is sensitive to these lower energy neutrinos would be of fundamental importance. To the first order, the chlorine experiment detects the B-8 neutrinos while bromine detects the much more abundant Be-7 neutrino source. In practice, the proposed bromine experiment would be very similar to the chlorine radiochemical experiment, except that Kr-81 with a half-life of 200,000 years cannot be counted by decay methods. With an experiment of about the same volume as the chlorine experiment (380 cu m) filled with CH2Br2, the model predicts about 2 atoms of Kr-81 per day. The bromine experiment depends entirely on the RIS method, implemented with pulsed lasers, for its success. DOE

N86-17257# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
ULTRAVIOLET IRRADIANCE FROM NATURAL SOURCES
H. Kaase May 1985 20 p refs
(PTB-Opt-18; ISSN-0341-6712) Avail: NTIS HC A02/MF A01

Extraterrestrial UV irradiance from the Sun (spectral distribution and solar constant) based on WMO, NASA, EC, and CIE values is given. Global irradiance for various solar zenith angles at sea level and the AM 1.5 direct (NASA and EC) as well as direct and diffuse (ISO) sun irradiance for the UV spectral range is presented. Data are compared with measured values. Author (ESA)

N86-17258*# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE ISEE-1 ULEWAT FLUX TAPE DESCRIPTION
G. M. Mason (Maryland Univ., College Park) and B. Klecker Jul. 1985 101 p refs
(Contracts NAS5-26739; BMFT-RV-14-B8/74; BMFT-010I-ZA-/WF/WRD-175/4)
(MPE-IN-43; ISSN-0340-8922) Avail: NTIS HC A06/MF A01

The ISEE-1 ULEWAT FLUX tapes of solar proton observations summarized over 1hr intervals are described. Three years of data fit onto one 1600 BPI 9-track magnetic tape. In making the tapes, corrections were made to the ULEWAT basic data tapes in order to, e.g., remove rate spikes and account for changes in instrument response, so that instrument fluxes can be calculated easily from the FLUX tapes without further consideration of instrument performance. Limitations and warnings about the use of the tapes are included. Author (ESA)

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N86-17259 Brandeis Univ., Waltham, Mass.
THE LARGE SCALE ANISOTROPY OF THE COSMIC MICROWAVE BACKGROUND RADIATION Ph.D. Thesis
Robert Karl Schaefer 1985 108 p
Avail: Univ. Microfilms Order No. DA8517051

Although the predicted moments of the distribution of the cosmic microwave background radiation in an inflationary universe have previously been calculated, the sensitivity of these moments of small changes in the conditions required by inflation had not been explored. In this thesis, formulae are presented for calculating the moments of the background radiation due to an arbitrary perturbation in the gravitational field of the early universe. It is found that only scalar (energy density) and tensor (gravitational wave) perturbations are important for his effect. Then numerical calculations are performed; first, to confirm the previous inflationary calculations which require a critical cosmological density and a Harrison-Zel'dovich scale invariant spectrum or perturbations, and second, to compute the values of the moments in universe with non-critical energy densities and different spectra (k + or - 1). The perturbations are caused by some random process which follows a Gaussian distribution, as this seems to be a reasonable feature of inflation to keep even in non-inflationary universe.
Dissert. Abstr.

N86-17260 Brandeis Univ., Waltham, Mass.
A RELATIVISTIC BLAST WAVE MODEL FOR OUTBURSTS IN QUASARS AND ACTIVE GALACTIC NUCLEI Ph.D. Thesis
Elizabeth Bennetts Hessel 1985 170 p
Avail: Univ. Microfilms Order No. DA8517037

A model for outbursts in quasars was developed. The shock follows the dynamics of relativistic spherical blast waves. The relativistic electrons in the shocked gas are assumed to have a relativistic Maxwellian energy distribution. The general behavior of these model outbursts is examined. The flux at early times has a broad spectrum; the flux peaks while optically thin at high frequencies as the peak in the Maxwellian radiation spectrum passes through. The flux peaks at low frequencies as the source becomes optically thin. Corresponding changes are seen in the peak flux and peak time behavior during the outburst. The shape of an outburst also depends on the angular size of the source and on how relativistic its motion is. Combined models in which the shock dynamics change during an outburst are also considered. One of the models is fit to outbursts in the quasar 3C454.3, and the corresponding physical quantities are derived. The energy requirements for these models are high, and the model flux does not completely follow the linear fall off observed. These blast wave models with peaked electron energy spectra do provide a good description of radio outbursts. Author

N86-17261 Ohio State Univ., Columbus.
AN ANALYSIS OF THE BORAD EMISSION LINE PROFILES OF SEYFERT 1 GALAXIES Ph.D. Thesis
Daniel Michael Crenshaw 1985 123 p
Avail: Univ. Microfilms Order No. DA8518929

High signal-to-noise spectra of twelve Seyfert 1 galaxies were obtained to study the broad emission line profiles. The observations were made with the image dissector scanner on the Perkins 1.8-m telescope. Three contamination effects that tend to weaken the core or strength the wings of the H beta profile relative to the H alpha profile are considered: (1) stellar absorption features from the host galaxy can significantly lower the peak of the H beta profile and introduce structure and asymmetries into the profiles of H beta, H lambda and He 1 lambda 5876; (1) an extended shell of emission in the red wing of the H beta profile is due to Fe 11 and at least one other species; (3) the H alpha profile is at a better velocity resolution than the H beta profile in the spectra, which leads to a weaker core for the H alpha profile. The large range in H beta/H alpha and He 1/H beta for a given Seyfert 1 galaxy indicates that the broad-line region is not a thin spherical shell. Author

N86-17262# Los Alamos National Lab., N. Mex.
COSMIC-RAY-PRODUCED GAMMA RAYS IN PLANETARY SURFACES
R. C. Reedy 1985 5 p refs Presented at International Conference on Nuclear Data for Basic and Applied Science Santa Fe, N. Mex., 13 May 1985
(Contract W-7405-eng-36)
(DE85-012750; LA-UR-85-1742; CONF-850507-26) Avail: NTIS HC A02/MF A01

A major priority of future NASA planetary missions is the determination of the elemental compositions of solar system objects. Gamma-ray spectroscopy will probably be used soon to determine the surface compositions of Mars and other solar system objects. Neutrons induced by the cosmic rays produce many of the important GAMMA-ray lines that escape from planets. Some measurements of the GAMMA rays produced by neutrons and protons with various energies have recently been made. However, many more nuclear measurements are still needed to plan for and to interpret the results from future planetary missions. Excitation functions for the production of GAMMA-ray lines by both neutrons and protons are needed in calculating the fluxes of GAMMA rays in and above a planet's surface. Thick-target irradiations with high-energy protons have simulated the production of (GAMMA) rays by the cosmic rays, and more simulations are planned. DOE

N86-17263# Pennsylvania Univ., Philadelphia. Dept. of Physics.
STUDY OF HIGH ENERGY PHYSICS UNDERGROUND
Oct. 1984 23 p
(Contract DE-AC02-81ER-40012)
(DE85-000824; DOE/ER-40012/T2) Avail: NTIS HC A02/MF A01

The Homestake Large Area Scintillation Detector consists of 140 tons of liquid scintlator in a hollow 8 m x 8 m x 16 m box surrounding the Brookhaven (37)C1 solar neutrino detector. The experiment is located at a depth of 4850 ft. (4200 m.w.e.) in the Homestake Gold Mine. Half of the detector is currently running; the full detector will be taking data by the fall of 1984. An extensive air shower is also currently under construction on the Earth's surface above the underground detector, consisting of 100 scintillators, each 3 sq m, covering approximately 0.8 km sq; the first portion of the surface array will also be providing data this fall. Together, the new Homestake detectors will be used to search for slow, massive magnetic monopoles; study the zenith angle distribution of neutrino-induced muons; search for neutrino bursts from the gravitational collapse of massive stars; measure the multiplicity and transverse momentum distributions of cosmic ray muons; and study the composition of the primary cosmic rays. The underground device and its capabilities as a monopole detector are described, followed by the surface array and the cosmic ray studies. DOE

N86-17264# Chicago Univ., Ill.
PARTICLE PHYSICS AND COSMOLOGY
M. S. Turner and D. N. Schramm 1 Sep. 1985 69 p
(Contract DE-AC02-80ER-10773)
(DE85-014780; DOE/ER-10773/T1) Avail: NTIS HC A04/MF A01

During the past year, the research of the members of our group has spanned virtually all the topics at the interface of cosmology and particle physics. Some topics studied were inflationary Universe scenarios, astrophysical and cosmological constraints on particle properties, ultrahigh energy cosmic ray physics, quantum field theory in curved space-time, cosmology with extra dimensions, superstring cosmology, neutrino astronomy with large, underground detectors, and the formation of structure in the Universe. DOE

99 GENERAL

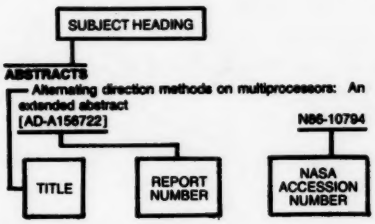
N86-17265*# National Aeronautics and Space Administration. Kennedy (John F.) Space Center, Cocoa Beach, Fla.
RESEARCH AND TECHNOLOGY Annual Report, 1985
Nov. 1985 62 p
(NASA-TM-83099; NAS 1.15:83099) Avail: NTIS HC A04/MF A01 CSCL 05A

As the NASA Center responsible for assembly, checkout, servicing, launch, recovery, and operational support of Space Transportation System elements and payloads, Kennedy Space Center is placing increasing emphasis on the Center's research and technology program. In addition to strengthening those areas of engineering and operations technology that contribute to safe, more efficient, and more economical execution of our current mission, we are developing the technological tools needed to execute the Center's mission relative to Space Station and other future programs. The Engineering Development Directorate encompasses most of the laboratories and other Center resources that are key elements of research and technology program implementation and is responsible for implementation of the majority of the projects in this Kennedy Space Center 1985 Annual Report. The report contains brief descriptions of research and technology projects in major areas of Kennedy Space Center's disciplinary expertise. Author

N86-17266*# National Aeronautics and Space Administration, Washington, D.C.
THE NINTH DR. ALBERT PLESMAN MEMORIAL LECTURE: THE FUTURE OF SPACE FLIGHT
Jesse W. Moore 1984 61 p Lecture held in Delft, Netherlands, 26 Oct. 1984
(NASA-TM-87558; NAS 1.15:87558) Avail: NTIS HC A04/MF A01 CSCL 05D

The history of space flight is reviewed and major NASA programs (Mercury, Gemini, Apollo, Skylab, Apollo-Soyuz, Science and Applications, Space Shuttle, Space Station) are summarized. Developments into the early 21st century are predicted.
Author (ESA)

Typical Subject Index Listing



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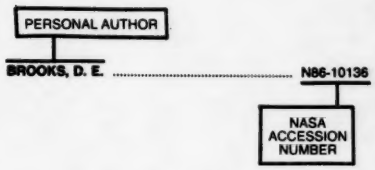

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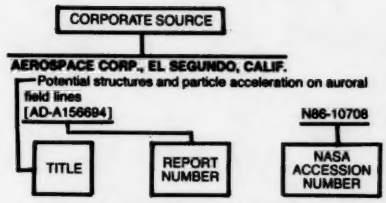

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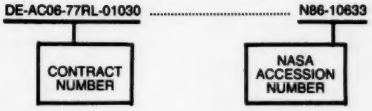

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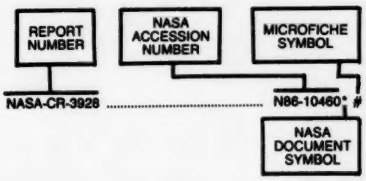

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NORTH DAKOTA

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(In cooperation with North Dakota State Univ. Library)

OHIO

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA

OKLAHOMA DEPT. OF LIB.
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

OREGON

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

PENNSYLVANIA

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927—Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

VIRGINIA

UNIVERSITY OF VIRGINIA
Alderman Lib.—Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA

WEST VIRGINIA UNIV. LIB.
Documents Department
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(304) 293-3640

WISCONSIN

MILWAUKEE PUBLIC LIBRARY
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(414) 278-3000

ST. HIST LIB. OF WISCONSIN
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(608) 262-4347

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WYOMING STATE LIBRARY
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